GOVERNMENT OF ANDHRA PRADESH
ABSTRACT

Industries & Commerce – HBIC - Publication of Final Master Plan of Orvakal Node under Hyderabad Bengaluru Industrial Corridor (HBIC) with an extent of 9,718.84 Acres – Notification - Orders – Issued.

INDUSTRIES & COMMERCE (INFRA) DEPARTMENT

G.O.MS.No. 121

Dated: 07-07-2025
Read the following

1. The Andhra Pradesh Industrial Corridor Development Act, 2017.
2. G.O.MS.No.46 of Ind & Com Department,dt.28.08.2020.
3. From the VC&MD, APIIC Ltd., single e-file bearing No. APIIC-16026/3/2024-ENGG WING I-APIIC (C.No.2355358), dt.16.02.2024.
4. Minutes of first meeting of Andhra Pradesh Industrial Corridor Development Authority held on 25.09.2024.
5. G.O.Ms.No.30, Industries & Commerce (Infra) Dept., dt.07.03.2025.

***

ORDER:

The Andhra Pradesh Industrial Corridor Development Authority (APICDA) was enacted through Act No.7 of 2018. The Andhra Pradesh Industrial Corridor Development Act, 2017 has come into force with effect from 10th October 2017 by virtue of notification published in the Extra-ordinary issue of Andhra Pradesh Gazette, dated:04.01.2018.

2. In the G.O.2nd read above, Government constituted the Andhra Pradesh Industrial Corridor Development Authority, Board and Executive Committee to operationalise the provisions of the Andhra Pradesh Industrial Corridor Development Act, 2017.

3. In the reference 3rd read above, the Vice Chairman & Managing Director, Andhra Pradesh Industrial Infrastructure Corporation Ltd., has requested the Government to issue Notification of Orvakal Industrial Node under Hyderabad Bengaluru Industrial Corridor in Andhra Pradesh Gazette under APICDA Act and

also issue Gazette notification of the Master Plan of Orvakal Node under HBIC.

4. In the reference 4th read above, the Andhra Pradesh Industrial Corridor Authority has accorded approval to declare Orvakal Node under Hyderabad Bengaluru Industrial Corridor, as Industrial Node under the Andhra Pradesh Industrial Corridor Development Act, 2017, and also accorded approval of Final Master Plan of Orvakal Node under HBIC with an extent of 9,718.84 Acres and instructed the Industries & Commerce Department, GoAP to take further action, in the first board meeting of Andhra Pradesh Industrial Corridor Development Authority held on 25th September, 2024.

5. In the reference 5th read above, Government declared Orvakal Node under Hyderabad Bengaluru Industrial Corridor, as Industrial Node, in exercise of the powers conferred under by Section 3(2) of the Andhra Pradesh Industrial Corridor Development Act, 2017.

6. Further, Government, after considering the resolution of the Andhra Pradesh Industrial Corridor Authority, in the reference 4th read above, Government hereby decided to publish the Final Master Plan of Orvakal Node under HBIC with an extent of 9,718.84 Acres.

7. Accordingly, the following notification shall be published in the Extraordinary issue of Andhra Pradesh Gazette dated:07.07.2025.

NOTIFICATION

The Government of Andhra Pradesh hereby publish Final Master Plan of Orvakal Node under HBIC with an extent of 9,718.84 Acres with the following land use pattern, as approved by Andhra Pradesh Industrial Corridor Authority under Section 9(1)(e) of the Andhra Pradesh Industrial Corridor Development Act, 2017. The Final Master Plan is appended to the Notification.

LAND USE PATTERN OF ORVAKAL NODE				
Land Use	Ph-1	Ph-2	Total	
	Area (Acres)	Area (Acres)	Area (Acres)	%
Industrial	1,423.73	3,593.59	5,017.33	52%
Transportation	216.6	258.17	474.77	5%
Residential	41.98	294.38	336.36	3%
Commercial	17.56	188.86	206.42	2%
Public & semi public	64.49	136.32	200.81	2%
Public utilities	217.35	239.35	456.7	5%

Roads	276.4	621.64	898.04	9%
Recreational	363.04	849.56	1,212.6	12%
Green Areas		510.18	510.18	5%
Water Body		405.63	405.63	4%
Total	2,621.15	7,097.68	9,718.84	100%

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

N.YUVARAJ
SECRETARY TO GOVERNMENT

To
The Commissioner of Printing, Stationery & Stores (Publ. Wing), Mutyalampadu, Satyanarayanpuram, Vijayawada – 520 011. (with a request to publish the notification in A.P. Gazette & supply 100 copies to Ind & Com Dept.)
The Director of Industries, Mangalagiri.
The Vice Chairman & Managing Director,
Andhra Pradesh Industrial Infrastructure Corporation,
Mangalagiri.
The Commissioner,AP Industrial Corridor Development Authority.

Copy to:-

The P.S. to Hon'ble Chief Minister. A.P.Secretariat
The P.S. to Hon'ble Minister (I&C) Department, A.P.Secretariat.
The P.S.to Hon'ble Minister for Finance Department, A.P.Secretariat.
The P.S. to Chief Secretary to Government, A.P.Secretariat.
The P.S. to Additional Secretary, Finance Department(FP),
A.P.Secretariat.
The P.S. to Principal Secretary, Municipal Administration & Urban Development, A.P.Secretariat.
The P.S. to Special Chief Secretary, Water Resources Department, A.P.Secretariat.
The P.S. to Special Chief Secretary, Revenue Department,
A.P. Secretariat.
The P.S. to Special Chief Secretary, Energy Department.
The P.S. to Principal Secretary, Panchayat Raj Dept.,
The P.S. to Secretary to Government & CIP, I & C Dept,
A.P. Secretariat,
Sf/Sc(2364746)

//FORWARDED::BY ORDER//

SECTION OFFICER

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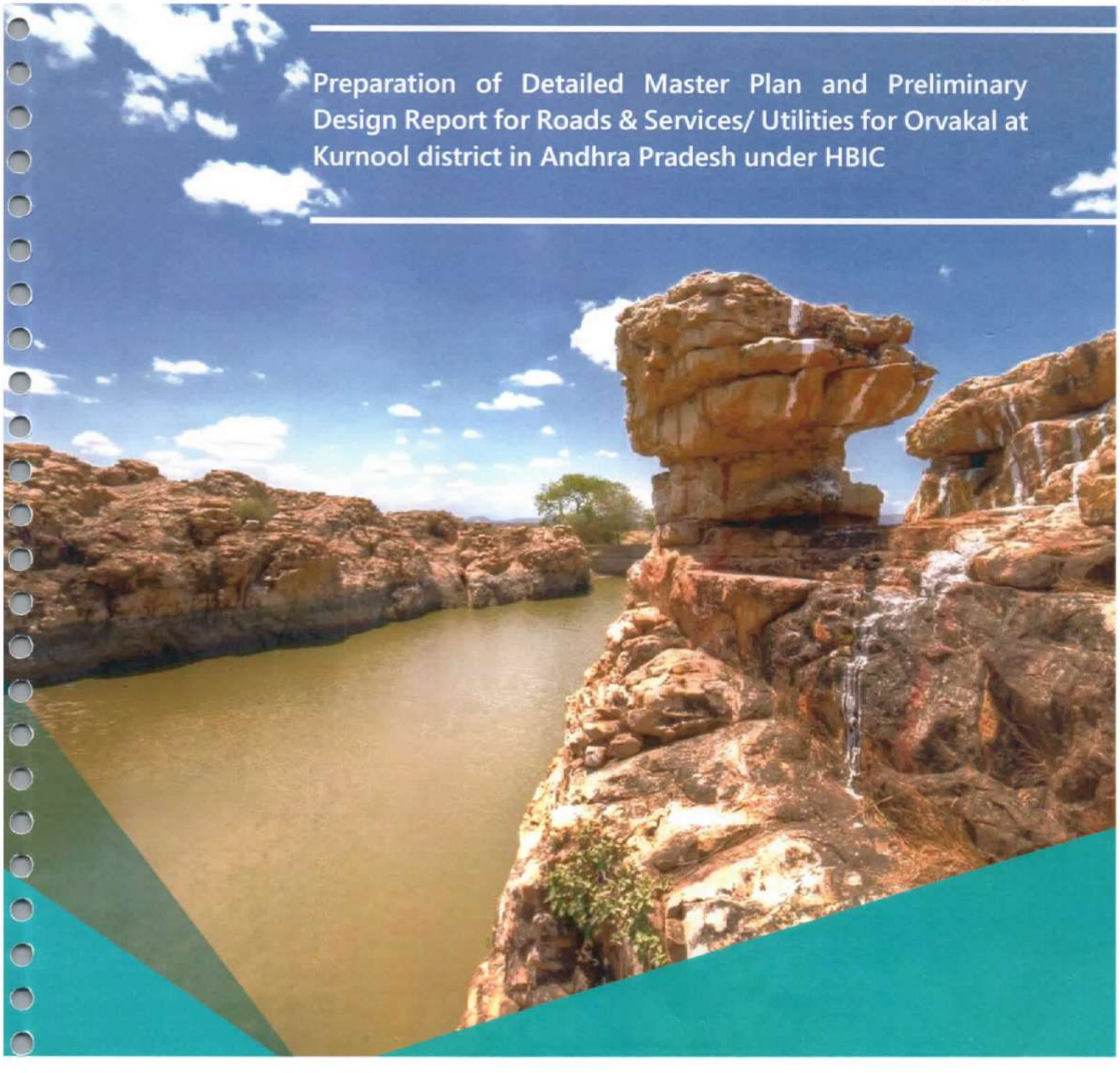
FINAL MASTER PLAN REPORT

ORVAKAL NODE

Nov 2023

Preparation of Detailed Master Plan and Preliminary Design Report for Roads & Services/ Utilities for Orvakal at Kurnool district in Andhra Pradesh under HBIC



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GENERAL INFORMATION

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DOCUMENT CONTROL

APPROVALS	NAME	DESIGNATION
Authored By	Bharat Vij	Urban Planner
	Papori Thakuria	Urban Planner
	Shalinee D. Prakash	AGM, Urban
	Gaurie Sharma	Architect
	Karri Rajesh	Urban Planner
	Sumidhi Nijhara	Landscape Architect
	R. Ramakrishna	Infrastructure Expert
	Sajal Bhowmick	MSW Expert
	Sanjay Kumar	Roads Expert
	Sanjeev Kumar	PHE Expert
	Ishita Manna	Landscape Architect
Reviewed By	J. Krishna	GM, Urban
	Arvind Pasula	Project Lead, Urban
	R. Ramakrishna	Infrastructure Expert
Approved By	**ION BESTELIU**	Team Leader

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RECIPIENTS

National Industrial Corridor Development Corporation
8th Floor, Tower-1, LIC, Jeevan Bharti Building,
Connaught Place, New Delhi-110001

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ABBREVIATIONS

NICDC	National Industrial Corridor Development Corporation
APIIC	Andhra Pradesh Industrial Infrastructure Corporation limited
HBIC	Hyderabad Bangalore Industrial Corridor
CMP	Concept Masterplan Report
FMP	Final Masterplan Report
RFP	Request For Proposal
SWOT	Strength Weakness Opportunity Threat
EC	Environmental Clearance
AAI	Airport Authority of India
VCIC	Vizag Chennai Industrial Corridor
KPI	Key Performance Indicator
NH	National Highway
SH	State Highway
UNR	Uyyalawada Narasimha Reddy
DRDO	Defence Research and Development Organisation
KC	Kurnool Cudduppah Canal
CSR	Corporate Social Responsibility
IT / ITES	Information Technology / Information Technology Enabled Services
OIA	Orvakal Industrial Area
HT	High Tension
NMT	Non-Motorised Transport
HMV	Heavy Motor Vehicles
LCV	Light Commercial Vehicles
ROW	Right Of Way
PSP	Public Semi Public
ATM	Automatic Transaction Machine
STP	Sewerage Treatment Plant
CETP	Common Effluent Treatment Plant
WTP	Water Treatment Plant
MBR	Mass Balancing Reservoirs
MUZ	Multi Utility Zone
IRC	Indian Roads Congress
MUTCD	Manual on Uniform Traffic Control Devices for Streets and Highways
TCRP	Transit Cooperative Research Program
UDIP	Universal Design India Principles
FAR	Floor Area Ratio
HIG	High Income Group
MIG	Middle Income Group
LIG	Low Income Group
ESR	Elevated Service Reservoir
CPHEEO	Central Public Health Environmental Engineering Organisation

ABBREVIATIONS

EV	Electric Vehicle
MRSS	Main Receiving Sub Station
GOAP	Government of Andhra Pradesh
ESS	Energy Storage System
G.O.M	Government Order Manuscript Series
ROM	Rough Order of Magnitude
ICT	Information and Communication Technology
SCADA	Supervisory Control and Data Acquisition

1

INTRODUCTION & BACKGROUND

1 - INTRODUCTION AND BACKGROUND

1.1 - Project Background

The National Industrial Corridor Development and Implementation Trust (NICDIT) has approved the proposal for development of Hyderabad Bengaluru Industrial Corridor (HBIC) in its 5th Board Meeting held on 19th August 2020. HBIC will have an Influence area spread across the states of Telangana, Andhra Pradesh, and Karnataka, connecting the central parts of the country with southern parts.

The National Industrial Development Corporation (NICDC) has appointed M/s Egis India in collaboration with M/s Egis International (hereafter referred to as Consultant) to prepare the Detailed Master Plan and Preliminary Engineering Report for the Orvakal Industrial Area in Kurnool District, Andhra Pradesh (referred to as Orvakal Industrial Area) under the HBIC Project. The Andhra Pradesh Industrial Infrastructure Corporation (APIIC) is the state-level nodal body for all industrial promotion initiatives in the state of Andhra Pradesh.

The Kick-off meeting with Egis project team, NICDC and APIIC was held on 11th January 2021 and chaired by CEO & MD, NICDC. Subsequent to Kick-off meeting, project team was deployed to Vijayawada and Orvakal for data collection and site appreciation.

As part of first milestone of Contract Agreement, EGIS submitted the inception report to NICDC on 15th February 2021.

A stakeholder workshop was conducted on 21st April 2021 and subsequently second deliverable of Market Demand assessment was submitted incorporating the comments of the workshop.

The Egis team undertook a detailed site survey as part of the base map deliverable between 28th March 2021 and 10th May 2021. This included a detailed boundary verification work together with APIIC surveyors and Village Revenue Surveyors. Subsequent to Base Map Report (KD-3) submission, the Land Suitability Analysis and Technical Assessment Report (KD-4) were submitted.

The Concept Masterplan Report (KD – 5) was submitted on 15th September 2021. This report included the three conceptual masterplans and their comparative analysis based on the proposed Key Performance Indicators (KPI).

The current milestone as per the scope of works is Notification of Final Master, wherein the client approved masterplan has been detailed out as per the RFP. A broad cost estimation along with the Development Control Regulations are also a part of this report.

1.1.1 - Broad project scope

The broad scope of work for the assignment given in the RFP broadly covers delivery of the following five components:

1. Project Management
2. Technical Assessment
3. **Master Planning**
4. Preliminary Design
5. EPC/ DB Tender Preparation

The current deliverable of Final Master Plan Report builds on previous submissions and in turn informs the preparation of the design basis for engineering works to be taken up in subsequent stages.

1.2 - Introduction

Andhra Pradesh benefits from having three major industrial corridors near each other, namely the Visakhapatnam Chennai Industrial Corridor (VCIC), Chennai Bangalore Industrial Corridor (CBIC), and Hyderabad Bengaluru Industrial Corridor (HBIC), with several industrial clusters planned in the region. Orvakal Industrial Area is part of the Hyderabad-Bangalore Industrial Corridor. Between CBIC and VCIC, HBIC (NH44) serves as a link. The HBIC follows the Golden Quadrilateral and spans more than 250 kilometres of Andhra Pradesh.

Figure 1.1 indicates all the three Industrial corridors running across the state of Andhra Pradesh.

Figure 1.1 – Three Major Industrial Corridors in Andhra Pradesh

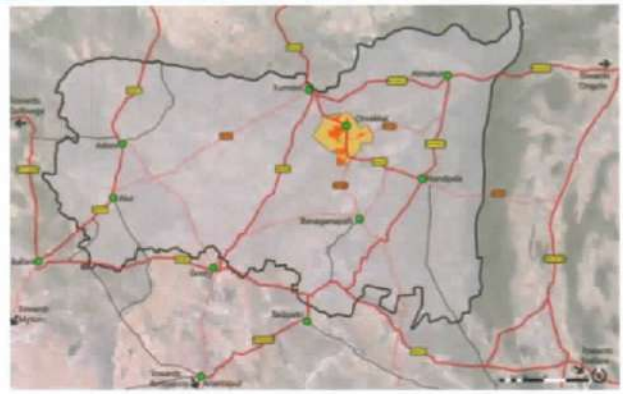
Source: Egis Analysis

1.3 - Site Location

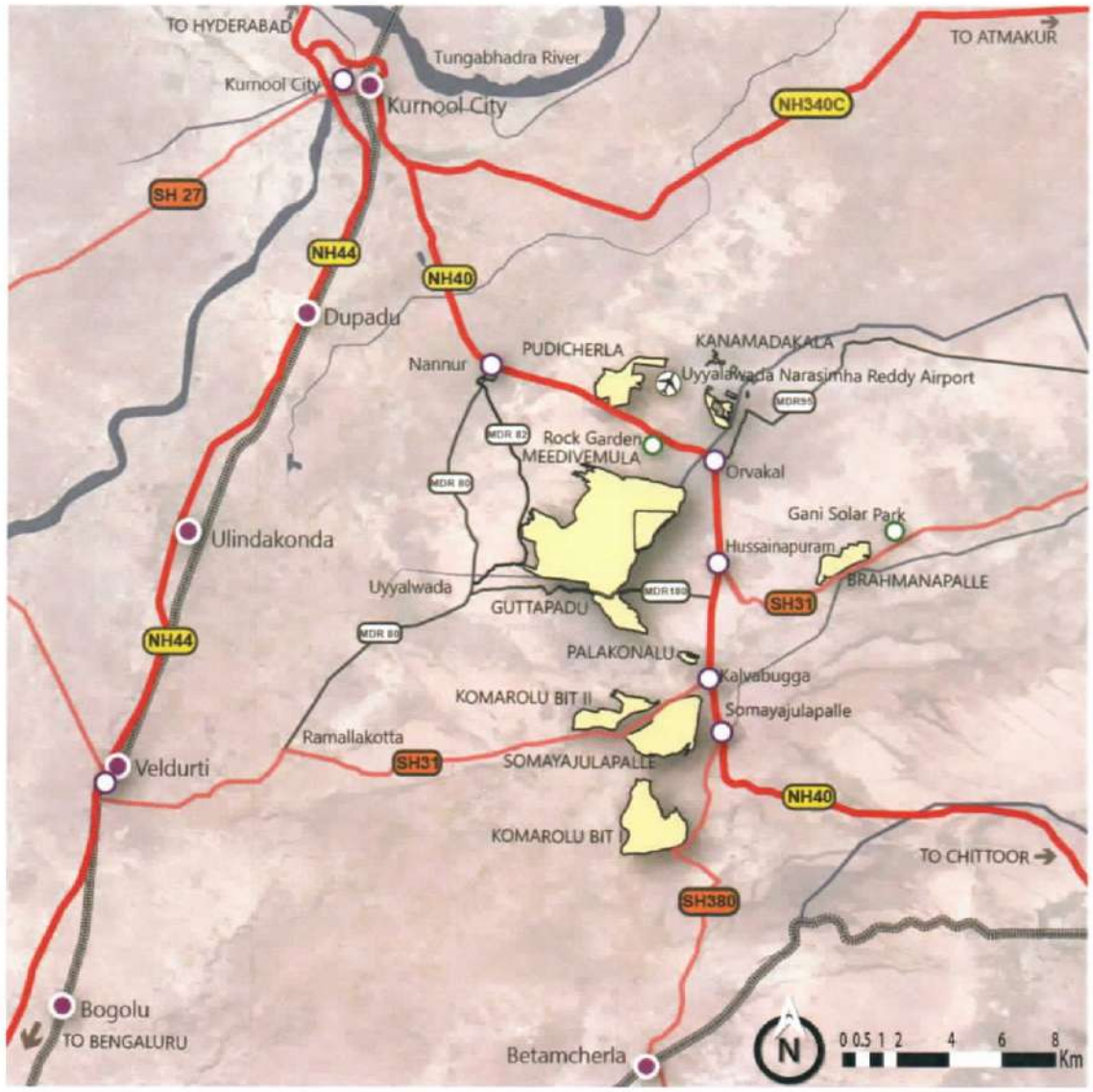
Figure 1.2 depicts the location of the proposed site for Orvakal Industrial Area within the state of Andhra Pradesh and Kurnool district.

Figure 1.2 - Site Location (Kurnool district, Orvakal and Orvakal Industrial Area)

Location of Kurnool district with AP state



Location of Orvakal tehsil within Kurnool district



Proposed Land Parcels for Orvakal Industrial area

Source: Egis Analysis

2

REGIONAL & SITE CONTEXT

2 - CONTEXT

2.1 - Introduction

This chapter discusses the regional context of the planned Orvakal Industrial Area, including its regional connections and links, as well as its distances from major metropolitan areas. Additionally, it provides the site context, which contains information about the land's bifurcation between APIIC and NICDC and the interconnection of the site's land parcels. This chapter also covers site analysis and SWOT analysis.

2.2 - Regional context

Orvakal Industrial Node's location is conveniently located between Bangalore and Hyderabad, two important economic powerhouses. The site is around 20 kilometres from NH44, which connects Bangalore and Hyderabad, and is immediately connected by NH40 (Kurnool - Chittoor National Highway). South Central Railways is in charge of the railway service. The nearest train station is Kurnool Railway Station. Veldurthi and Ulindakonda, two small railway stations on the Bangalore-Hyderabad Railway line, are located 20–30 kilometres west of Orvakal Node.

The Table 2.1 below indicates the distances from the site to key urban centres and ports within the region and its accessibility via major transport routes

Table 2.1 - Regional Overview

S.NO.	PARTICULARS	DESCRIPTION
1	*Distance from Metropolitan/ major city*	• 25 Km from Kurnool City • 50 Km from Nandhyal Municipality • 250 Km from Hyderabad City Center • 350 Km from Bengaluru
2	*Accessibility to trunk road network*	• NH-40 SH-31 and SH-380 passes through the site
3	*Accessibility to railway network*	• 25 Km east of Kurnool Railway Station
4	*Accessibility to Seaport*	• 320 Km west of Krishnapatnam Port • 420 Km west of Kattupalli Port, Ponneri
5	*Accessibility to Airport*	• Kurnool Airport Located at Orvakal adjacent to our site • 170 Km from YSR Cuddapah Airport

Source: Egis Analysis

Figure 2.1 shows the regional context for Orvakal Node.

2.3 - Regional Connectivity

2.3.1 - External Linkages and Access

The National Highway (NH 40), which connects Kurnool and Ranipet through Kadapa and Chitoor, passes through Orvakal Mandal. The Kurnool-Guntur State Highway (SH 60) lies 11 kilometres north of the project site and connects Kurnool and Guntur. Orvakal, located 1.7 kilometres northeast of the project site, is the nearest town. NH-40 connects the *Pudicherla, Kannamadakala, and Guttapadu clusters* in Orvakal Mandal sub-district by village roads and the remainder sites via state highways, running west to east from the fringes of Kurnool metropolitan area to Orvakal town. Major district roads and village roads make the Guttapadu cluster accessible from all the directions. Komarolu Bit-I can be accessed by State Highway 380 and an undeveloped village road adjacent to the parcel.

Figure 2.1 – Regional Context Map

Source: Egis Analysis

2.4 - Site Context

2.4.1 - Land Bifurcation Details

The project site is made up of eight parcels that span 12 villages in Orvakal Mandal. Out of the total land area of 9718.84 Acres where Existing Industrial area is 413.19 Acres allotted to Jai Raj Ispat and remaining area of 9305.65 Acres is newly proposed for Industrial development. In **9305.65 Acres**. 7267.02 Acres of land is in the possession of APIIC and about 2038.63 Acres comprise of Patta, Assigned (DKT) and government land parcels for which the requisition proposals have been filed for land acquisition to an extent of 1768.81 Acres (Patta + Assigned) + 269.82 Acres (Govt. Land). An additional 413.19 acres of land is already alloted to M/s Jairaj Ispat and is not included in the 9305.65 Acres.

The following are the eight site parcels, with their area divided between APIIC and NICDC :

Table 2.2 – Land Bifurcation Details

SL. NO.	VILLAGE NAME	APIIC LAND	NICDC LAND	TOTAL LAND
1	Pudicherla	719.36	0	719.36
2	Kannamadakala	243.69	0	243.69
3	Guttapadu cluster	2471.17	2621.15	5092.32
4	Somayajulapalle	0	1275.77	1275.77
5	Palakolanu	61.5	0	61.5
6	Komarolu Bit I	0	845.42	845.42
7	Komarolu Bit II (Chintapalle)	419.34	0	419.34
8	Brahmanapalle	447.90	0	447.90
9	Exisitng Industry Jai Raj Ispat in Guttapadu	413.19		413.19
TOTAL		**4976.50**	**4742.34**	**9718.84**

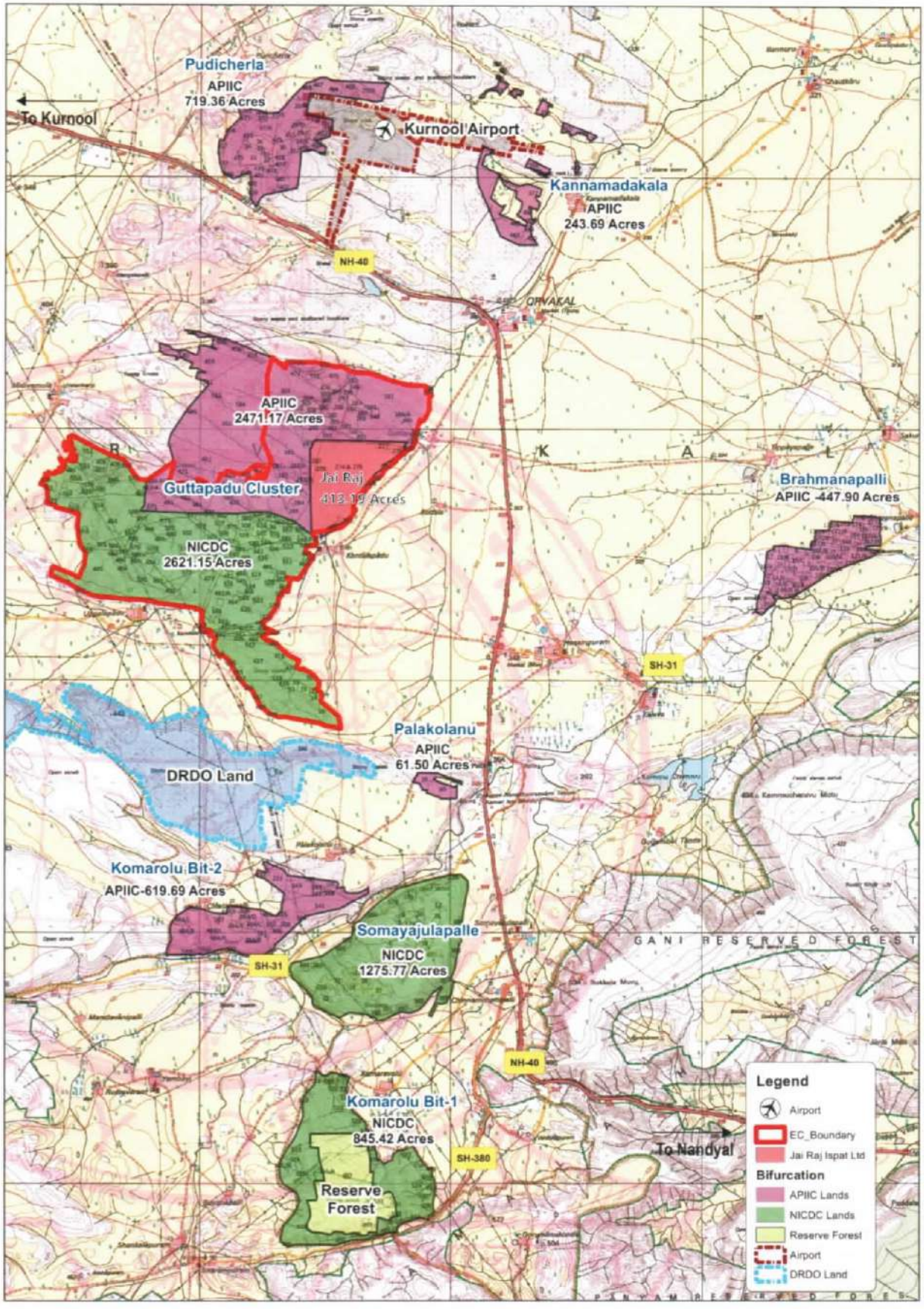
Source: APIIC

The overall developable area for the Orvakal Industrial area is 8849.75 acres, minus 409.36 acres for waterbodies, streams, canals, and any inconsistencies in Survey figure.

Table 2.3 – Net Developable Area for Masterplanning for each parcel

LAND PARCEL	AREA AS ON SITE (CAD DRAWING) (IN ACRES)	AREA AS PER REVENUE RECORDS (IN ACRES)
Guttapadu	5136.60	5092.32
Pudicherla	672.20	719.36
Kannamadakala	259.68	243.69
Brahmanapalle	444.13	447.90
Palakolanu	58.25	61.5
Somayajulapalle	1257.75	1275.77
Komarolu Bit – I	834.36	845.42
Komarolu Bit - II	598.86	619.69
Exisitng Industry Jai Raj Ispat	423.00	413.19
Total	**9684.82**	**9718.84**

Figure 2.2 – Land Bifurcation Map



Source: Egis Analysis

2.4.2 - Site Land Parcel Connectivity

2.2.1.1 Pudicherla Land Parcel

The Pudicherla parcel lies in close proximity to the Orvakal Airport and is abutting NH-40. The existing approach road towards the Pudicherla Village needs to be strengthened to be utilised as an approach road to the site.

2.2.1.2 Kannamadakala Land Parcel

This parcel has an approach from Miduthuru – Orvakal road (MDR95). The existing approach is a cart track and needs to be upgraded. It is intersected by a canal for which a culvert needs to be proposed.

2.2.1.3 Meedivemula and Guttapadu Land Parcel

This is the major site land parcel and multiple access from NH40 has been proposed. The existing approach road from NH-40 near Orvakal village comes southwards to Guttapadu cluster is fairly developed for providing connectivity to northern zone of the cluster. Another approach from NH40, off-shoots close to approach road to Kurnool Airport and runs southwards close to Meedivemula area, is from MDR-82 and MDR-80, which can be explored in future for additional connectivity. After crossing Orvakal village, NH-40 bends southwards, so connectivity to southern zone of this Guttapadu cluster via MDR 180 shall be beneficial for project.

2.2.1.4 Palakolanu Land Parcel

The Palakolanu node, which is located near the DRDO facility, also has access from NH-40 through an existing village road. Additionally, since it is located between the Guttapadu cluster and the Somayajulapalle parcel, it provides convenient access to both parcels.

2.2.1.5 Komarolu Bit I Land Parcel

This land parcel is a plateau and the southernmost site land parcel. It has two approach roads, indirectly from NH-40 via a village road from the north and a direct access from SH-380 from the south. The northern approach from NH-40 can be developed as its primary approach into the site, as the topography along the access abutting SH-380 include steep slopes.

2.2.1.6 Komarolu Bit II Land Parcel

The land parcel abuts SH-31, however an existing village road via Palakolanu can be strengthened, to provide additional connectivity back to NH-40.

2.2.1.7 Somayajulapalle Land Parcel

Somayajulapalle land parcel is a plateau with mild slope all along its perimeter. This site parcel has two approach roads from NH40, while the northern approach SH-31 can provide access to this land parcel, the existing cart road on the south may not be viable due to steep slopes.

2.2.1.8 Brahmanapalle Land Parcel

This site parcel has a direct approach from east-bound SH-31, which in turn connects back to NH-40. Fig 2.3 highlights the proposed access roads to each site cluster.

Table 2.4 – External Site Connectivity - Guttapadu

SL. NO.	PROPOSED ROW	LOCATION POINT	LENGTH (IN MTRS)
1	30.0 MTR WIDE ROW	P-01 TO P-12	902
2	30.0 MTR WIDE ROW	P-02 TO P-12	421
3	30.0 MTR WIDE ROW	P-12 TO P-13	2926
4	45.0 MTR WIDE ROW	P-03 TO P-14	1623
5	45.0 MTR WIDE ROW	P-06 TO P-15	3971
6	30.0 MTR WIDE ROW	P-07 TO P-16	3012
TOTAL			**12855**

Table 2.5 – External Site Connectivity - Kannamadakala

SL. NO.	PROPOSED ROW	LOCATION POINT	LENGTH (IN MTRS)
1	30.0 MTR WIDE ROW	P-04 TO P-25	2776
2	24.0 MTR WIDE ROW	P-25 TO P-26	450
3	18.0 MTR WIDE ROW	P-25 TO P-27	1284
4	18.0 MTR WIDE ROW	P-27 TO P-28	1291
5	18.0 MTR WIDE ROW	P-27 TO P-29	4441
TOTAL			**10242**

Table 2.6 – External Site Connectivity - Brahmanapalle

SL. NO.	PROPOSED ROW	LOCATION POINT	LENGTH (IN MTRS)
1	30.0 MTR WIDE ROW	P-05 TO P-30	8021
TOTAL			**8021**

Table 2.7 – External Site Connectivity - Somayajulapalle

SL. NO.	PROPOSED ROW	LOCATION POINT	LENGTH (IN MTRS)
1	30.0 MTR WIDE ROW	P-08 TO P-19	6852
2	45.0 MTR WIDE ROW	P-09 TO P-22	580
TOTAL			**7432**

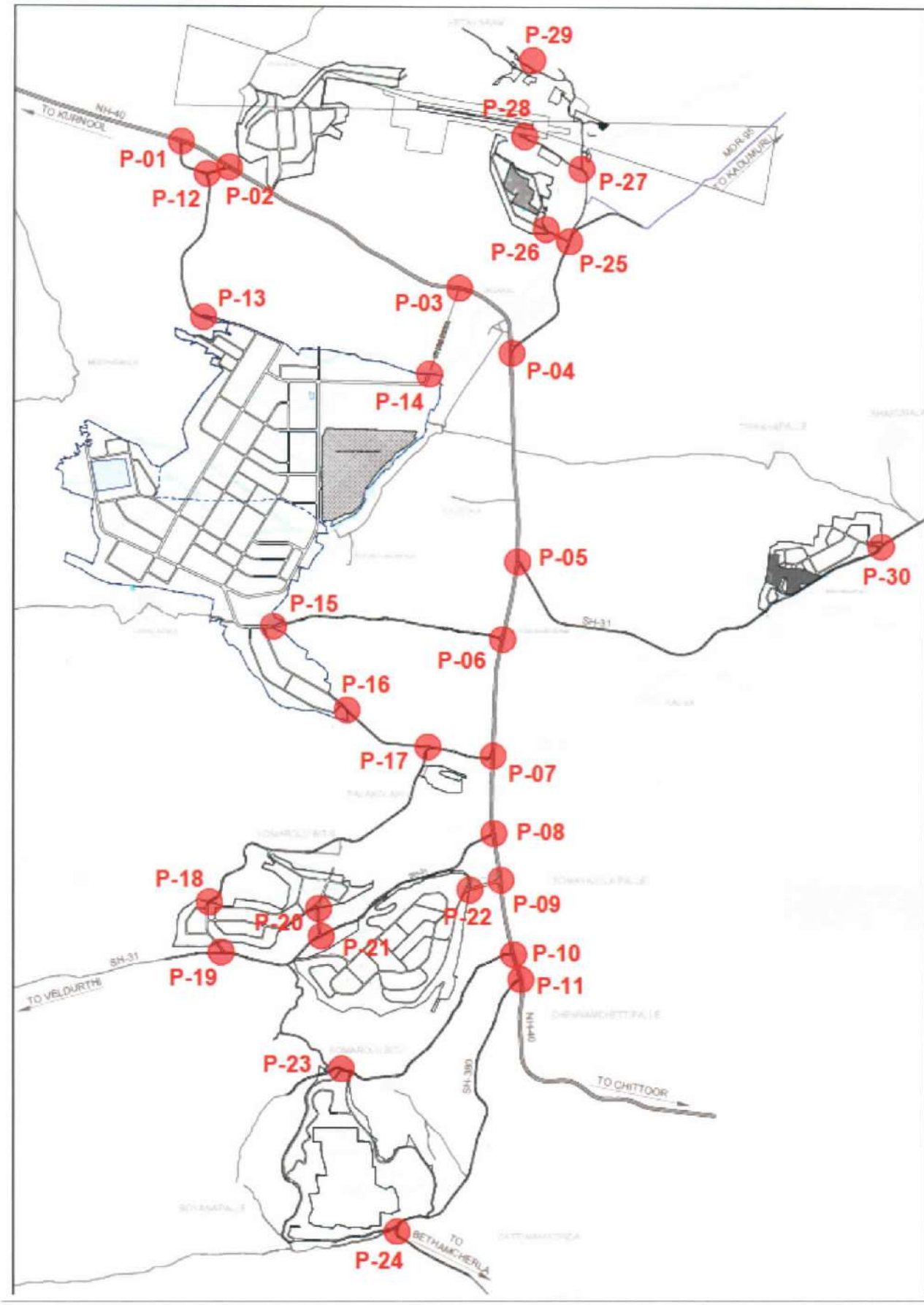
Table 2.8 – External Site Connectivity – Komarolu Bit - 1

SL. NO.	PROPOSED ROW	LOCATION POINT	LENGTH (IN MTRS)
1	30.0 MTR WIDE ROW	P-10 TO P-23	4348
2	30.0 MTR WIDE ROW	P-11 TO P-24	5836
TOTAL			**10184**

Table 2.9 – External Site Connectivity – Komarolu Bit – 2

SL. NO.	PROPOSED ROW	LOCATION POINT	LENGTH (IN MTRS)
1	30.0 MTR WIDE ROW	P-17 TO P-18	5758
2	30.0 MTR WIDE ROW	P-20 TO P-21	500
TOTAL			**6258**

Figure 2.3 – Proposed Site Connectivity



Source: Egis Analysis

2.5 - Site Analysis

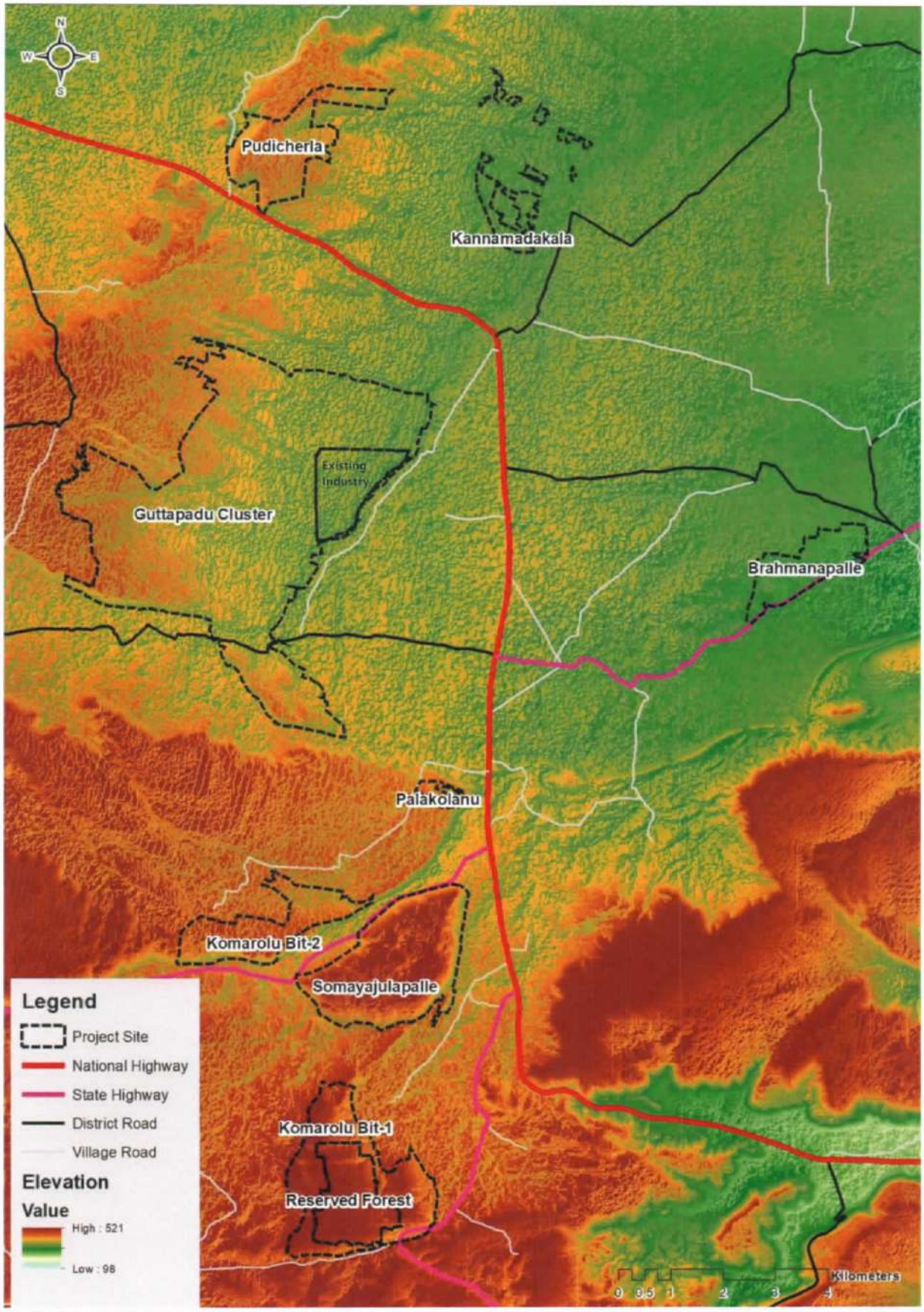
2.5.1 - Site Topography

Except for the southernmost parcels of Komarolu Bit-II, Somayajulapalle, and Komarolu Bit-I, which have undulating topography with gentle to mild slope, the topography of all the parcels is generally flat with plateau-like sections and has a gradual slope of 2.5 percent from north-west to south-east. The access road from the west side creates a gradual elevation increase in the northernmost portion of the project site, Pudicherla, while the remaining topography is rather flat within the rest of the land parcel. Kannamadakala, which is south-east of the Kurnool airport, and the Brahmanapalli parcel both have a comparatively flat landscape.

Guttapadu's contiguous parcel features a moderate sloping landscape with few streambed depressions. A cliff-like structure with an elevation drop of 20-30 metres at the south west boundary of Guttapadu parcel leads to a passing stream outside the land parcel. Somayajulapalle and Komarolu Bit II parcels feature a plateau-like topography with a minor undulation. Outside of the reserve forest area, the Komarolu Bit I land parcel includes an undulating topography with a Hillock feature in the south-east and a cliff along the project's western boundary.

Fig 2.4 shows the existing site topography.

Figure 2.4 – Site Topography



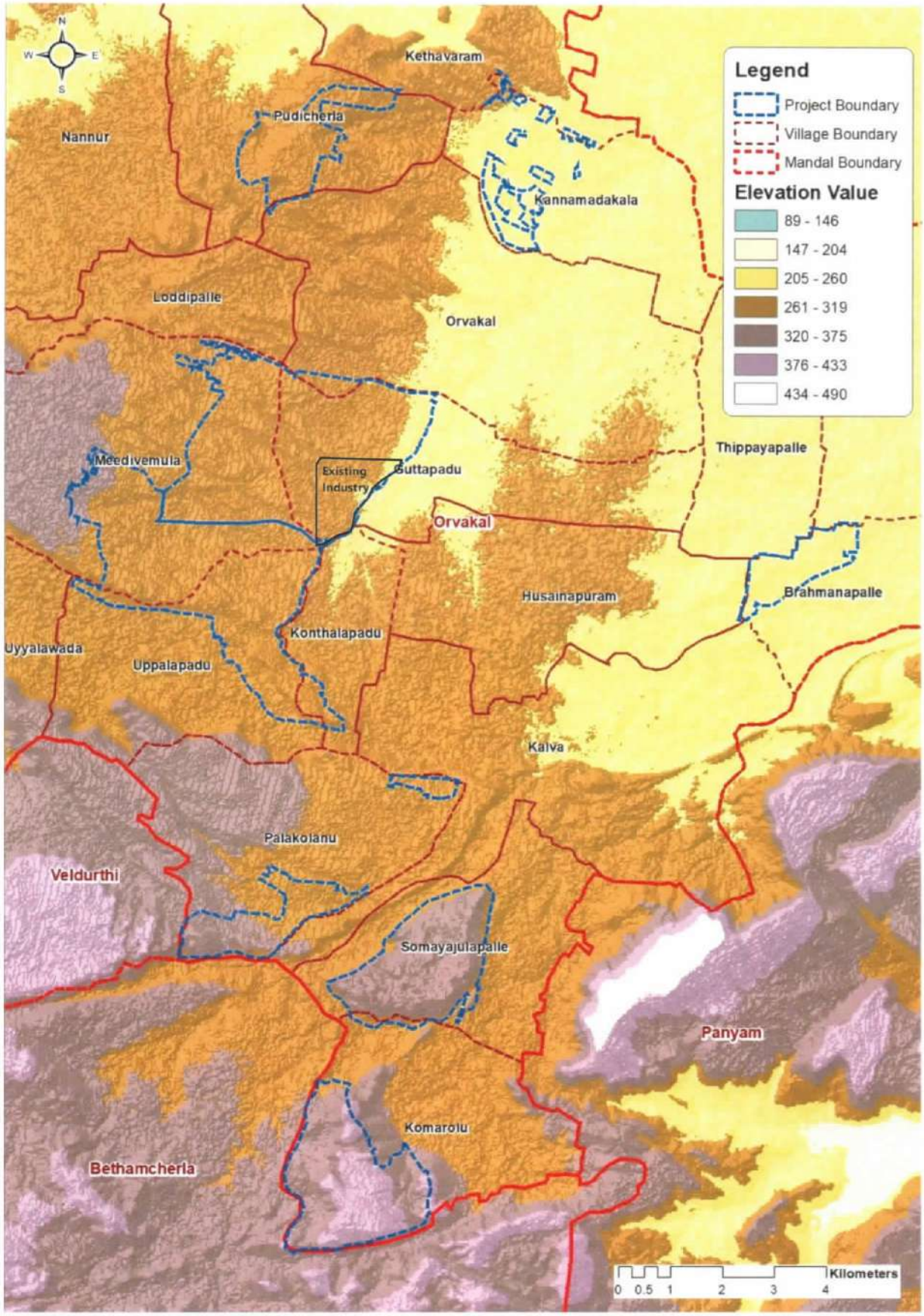
Source: Egis Analysis

2.5.2 - Site Elevation

The project region and its surroundings have an average elevation range of 205 to 319 metres. The project site has the lowest height in the eastern halves of the Brahmanapalle and Kannamadakala land parcels and the highest elevation in the south-east half of the hilly Komarolu Bit-I parcel. On the western edge of the Pudicherla parcel, there is a cliff with a height difference of around 8 metres. Both the Guttapadu and Palakolanu parcels have a cliff feature with a slope and an elevation difference of 20-30m and 25-30m, respectively, due to the presence of a stream bed.

The land parcels of Somayajulapalle and Komarolu Bit II have a plateau-like terrain with sharp elevation declines towards SH-31. However, Somayajulapalle south-eastern border has an elevated edge, with elevation differences of 50-60 metres in the south and north, 40-50 metres in the east, and 35-40 metres in the west. The elevation difference between the Komarolu Bit-I and the adjacent State Highway (SH-380) in the south is approximately 80-90 metres, while the elevation difference between its boundary and the surrounding area is approximately 40-60 metres. The existing site elevation is depicted in Fig. 2.5.

Figure 2.5 – Site Elevation



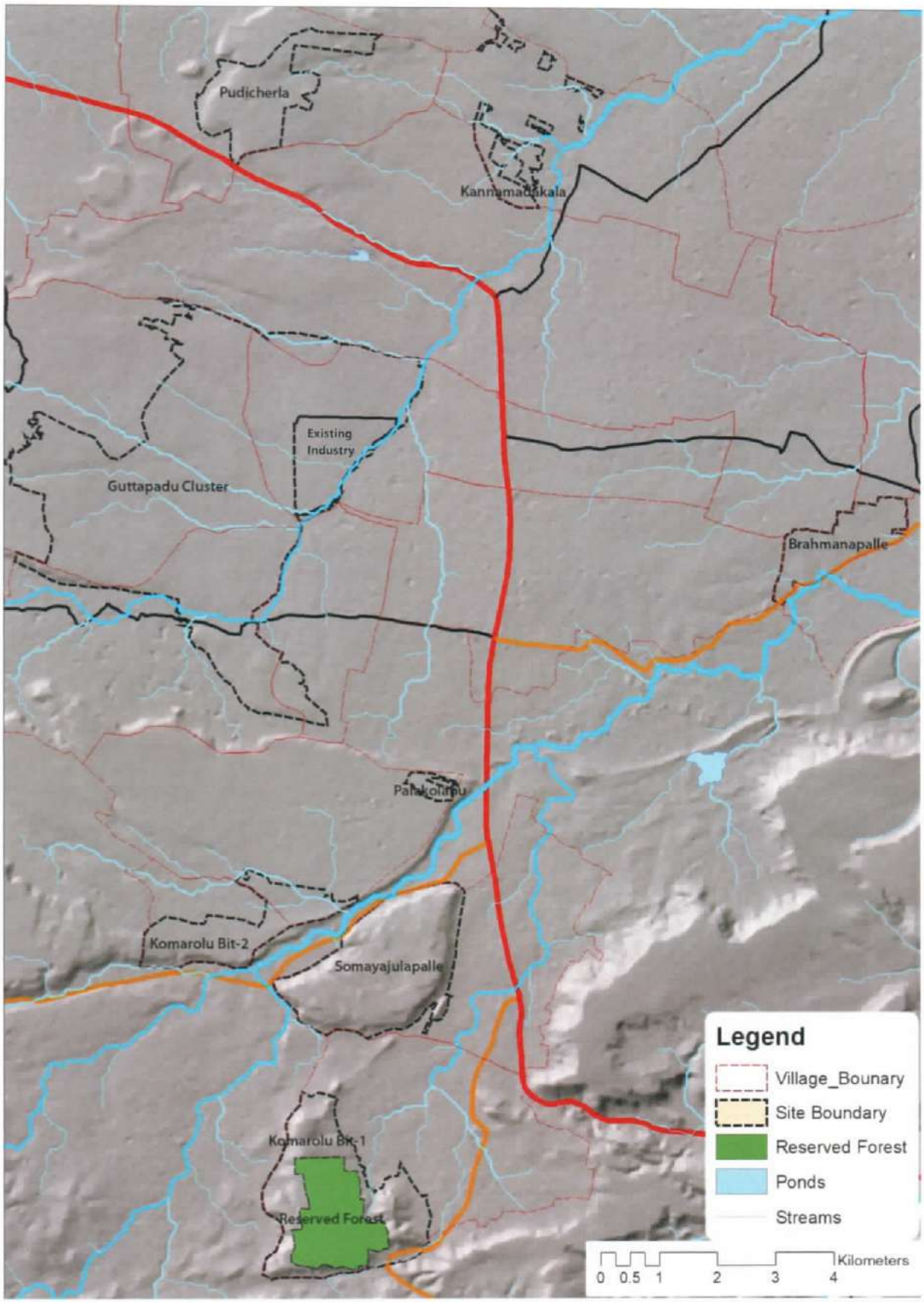
Source: Egis Analysis

2.5.3 - Drainage Pattern

As it is south of the Tungabhadra River bend between the states of Andhra Pradesh and Telangana, the project area is surrounded by a number of large and minor water bodies. The Handri River, another significant river offshoot from the Tungabhadra basin, travels north to south around 10-15 km west of the project area. The KC canal is an irrigation channel that spans north to south and shares boundaries with the Guttapadu cluster's largest land parcel. Minor streams can be found across the project site area, with the majority of them in the Guttapadu cluster, Komarolu Bit-I, and less in the other six land parcels. The small streams found throughout the Guttapadu cluster are contiguous and typically flow from the northwest or west into the KC Canal, but the streams of all other land parcels are seasonal and are interrupted by undulating geological layers and topographical conditions.

Figure 2.6 shows the existing drainage pattern.

Figure 2.6 – Drainage Pattern



Source: Egis Analysis

2.5.4 - Natural Features

The current landuse on the site, as well as within a 10-kilometer radius, is primarily undeveloped or agricultural land. The land usage at the proposed site is mostly open scrub and rocky. The project's catchment region is part of the Kunderu River basin. The Kunderu River flows in southern direction and meets Pennar River near Kamalapuram village, which is 124 km, hence the major catchment area of the project falls under Pennar River basin. A primary irrigation canal, Kurnool Cuddapah Canal (KC Canal) off-takes from Sunkesula Anicut on Tungabhadra River, traverses through Kurnool and Kadapa districts and finally terminates at Cuddapah.

The project location is roughly 12-15 kilometres away from the Rollapadu Wildlife Sanctuary. Much disturbed and degraded thorn woodland can be found on fallow lands or farmed areas, particularly in the area around Brahmanapalle village. Komarolu Bit I parcel shares a border with the Komarolu RF block, which was designated as a reserved forest area in 1965 and contains sparse vegetation inside its 500 acres. There are existing HT lines along the Guttapadu parcel, Komarolu Bit I, and the northernmost parcels.

Figure 2.7 – Existing Site Features

Water body at Kalva Bethamcherla Road

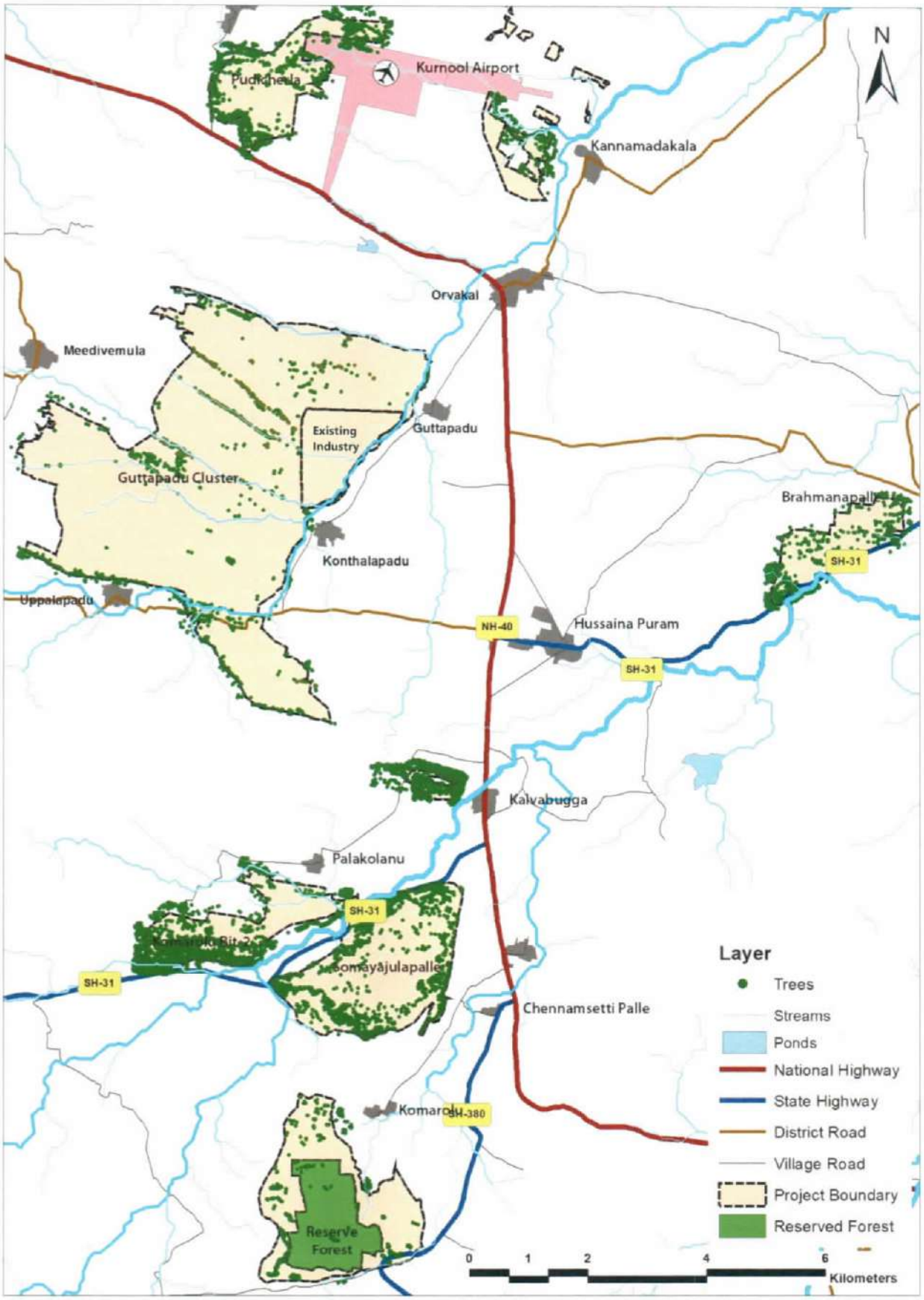
The hilly site of Komarolu Bit I

Patta lands with stone boundaries

Existing HT lines within the site

Source: Egis Analysis

Figure 2.8 – Natural Features

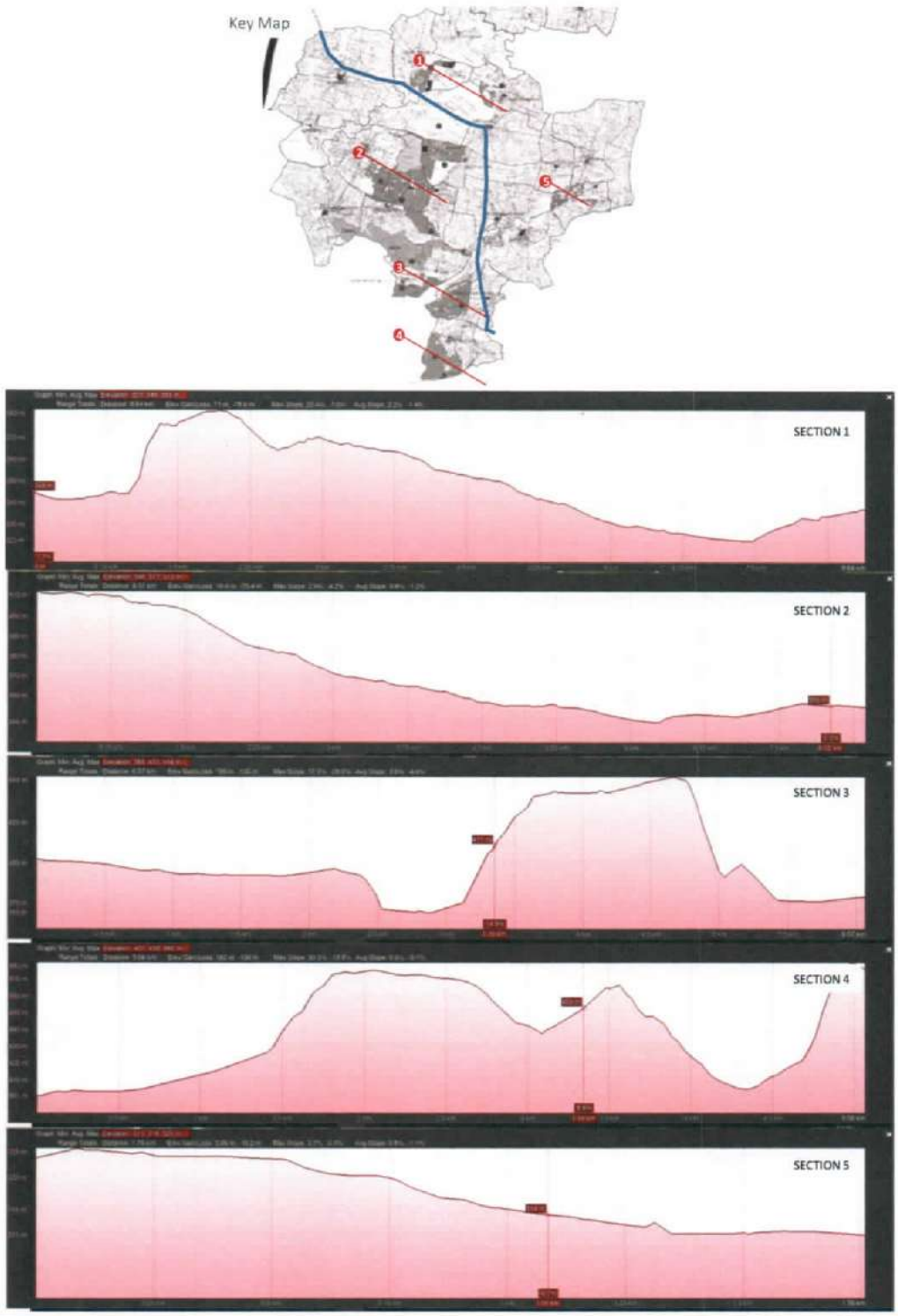


Source: Egis Analysis

2.5.5 - Slope Analysis

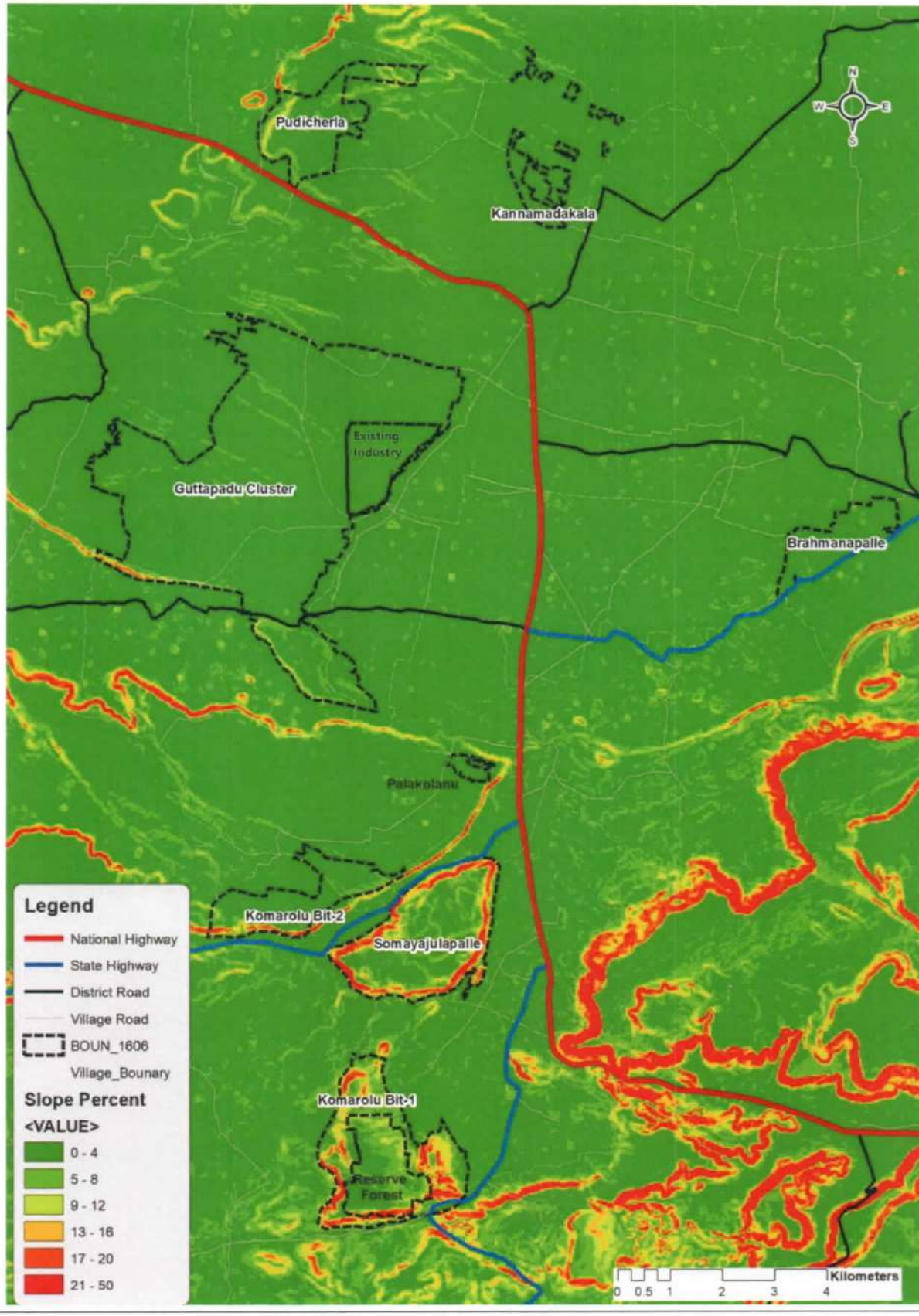
The sites are in a relatively flatter area in the northern and central areas. The areas of Komarolu and Somayajulapalle, located to the south of the project site, have high topography with slopes exceeding 20%. The location is primarily located in places with slopes of less than 10%. Slopes greater than 20% are found in only a few areas in the project area. These are usually found on the sides of hills and in gorges.

Figure 2.9 – Part Sections Across Site Land Parcels



Source: Egis Analysis

Figure 2.10 – Slope Analysis



Source: Egis Analysis

2.5.6 - SWOT Analysis

STRENGTHS
• The site is centrally located between the economic megacities of Hyderabad and Bangalore. • Well, connected through National and state highways, situated near Kurnool Airport and A-Category Railway station at Kurnool. • Directly connected to Ponneri and Krishnapatnam ports through National and state highways and is a seven-nine hours' drive from either of the ports. • The site is in close proximity to Kurnool, one of the largest cities of Andhra Pradesh. • Predominantly flat land and less vegetation on site; master planning and design with less on-site constraints. • More than 85% of land is under possession of the APIIC and the remaining area is also being requisitioned. • Ongoing projects are getting approved and infrastructure projects will be fast tracked. • Availability of abundant power sub stations with well-developed grid infrastructure and are in close proximity to the project site. • Unique landscape with high scenic value and strong natural edges. • Good wind speeds of about 25 to 30 Km/hr available in and around the site.
OPPORTUNITIES
• **Connectivity to surrounding**– Well connected through National Highway NH40. All land parcels are directly or indirectly connected to NH40 via village roads. • **Interconnectivity** (off highway) between the land parcels is highly viable for Guttapadu, Palakolanu, Somayajulapalle, Komarolu Bit I and II sites. • **Power** – Presence of power sub stations with well-developed grid infrastructure and are near the project site. • **Water Supply** – Planned water supply to site from Srisailam reservoir and Summer Storage Tank at Guttapadu. • **Water Channels** – presence of water streams gives opportunity for natural drainage and ground water recharge by rainwater. • **Wind** – Good wind speeds of about 25 to 30 km / hr around the site. • **Tourism** – Rock Garden, a famous tourist spot is near the site. • Synergy with Kurnool airport (adjacent to the site) will be a tremendous advantage to the project and can be capitalized on. • Potential for high value industries such as Defence related industries, Rocket Propellant Fuel, Pharmaceuticals, Automobiles, and high-quality steel products. • The presence of DRDO facility to act as a huge pull for parts suppliers and ancillary units for defence purposes. • The approved Railway Coach Rehabilitation facility can serve as a pull factor for various component manufacturers. • The site and its vicinity have huge potential to utilize solar energy. Thus, the use of renewable energy such as solar energy can be promoted in and around the project site. • The proposed Ramayapatnam port can boost the sea connectivity of the project site and boost the export potential along with a proposed inland water port. • Site is in Seismic Zone 1 and thus offers the potential for high-risk industries such as Chemical plants, refining units etc. • An inland water port on the Tungabhadra River can provide direct connectivity to the sea from the site. • EC obtained for part of the site which can be extended to the entire area under one project.

WEAKNESSES

- **Fragmented Land Parcels** – All land parcels are segregated and discontinuous in nature. Kannamadakala also has very small and scattered land parcels. Connectivity and holistic trunk infrastructure could be expensive to design and implement with minor economic benefits.
- **Approach** –Indirect connectivity of most land parcels to NH 40 makes it critical for widening and strengthening of connecting state highways and village roads.
- **Airport Approach Funnel** – Land parcels of Pudicherla and Kannamadakala will have to comply to AAI's restrictions of noise, air quality and height that needs to be maintained within the area falling under Airport Funnel. Also, heavy industries like electronic industries cannot be planned near ATC zone.
- **Proximity to Eco Sensitive Area**–Site is in proximity (within 50 kms) to Eco Sensitive areas. The Rollapadu Bird Sanctuary is around 10kms (required for EC) from Brahmanapalle parcel.
- **Reserved Forest** – Presence of reserved forests in the centre of Komarolu Bit I land parcel. Adequate buffers will be required for planning industries around RF.
- **Topography** – The topography of the site is undulating in nature. Some parcels like Somayajulapalle and Komarolu Bit I are plateaus and consist of rocky features.
- **Climate** – Hot and dry sub humid climate in the region almost throughout the year.
- Lack of significant ICT infrastructure near the site.

THREATS

- Threats related to fallout from Defence research / NFC area.
- Land acquisition in process and possibility of PAP.
- Proximity to forest lands within 50 Km radius.
- Land degradation is a potential concern and drainage channels need to be properly planned to conserve soil fertility and avoid downstream land degradation.

3

VISION FORMULATION

3 - VISION

3.1 - Vision Formulation

3.1.1 - Introduction

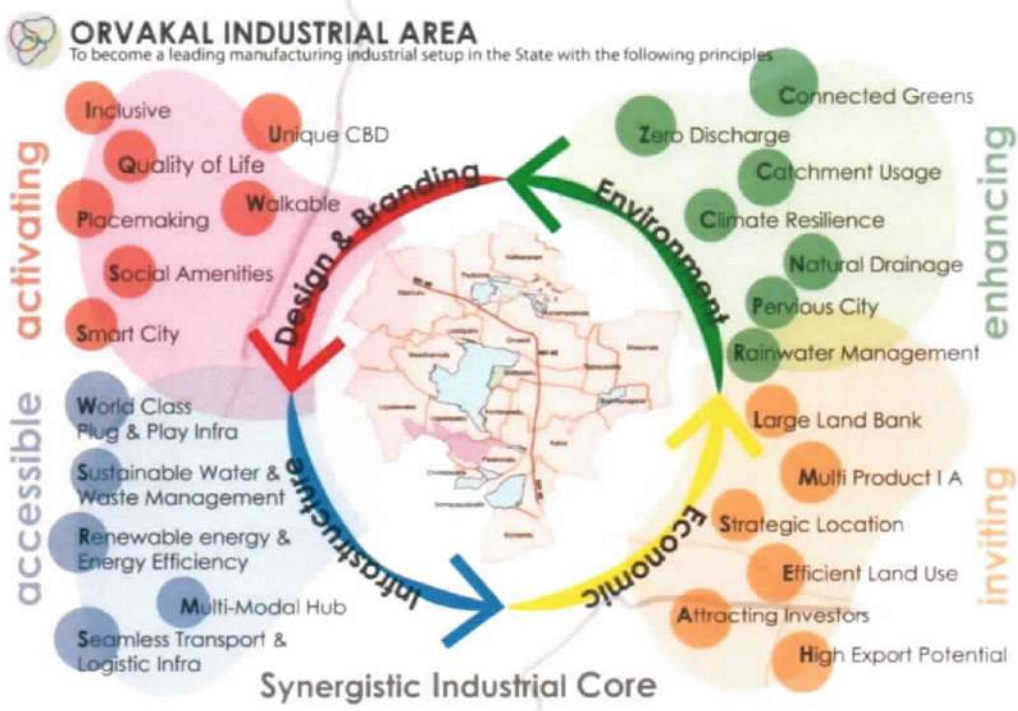
Visioning exercises for master planning aid in developing consensus about the needs of how the development is perceived and deciding what is required to achieve it. A well-thought-out vision statement is one of the elements required to create a forward-thinking strategic framework that provides developers with the long-term perspective required to guide development within an umbrella of overarching principles.

3.1.2 - Vision for Orvakal Industrial Area

To address the key opportunities and constraints highlighted in the site assessment section, a Development Umbrella has been visualized. This conceptual framework consists of a series of multiple development principles for investigating and recommending measures to promote holistic development of Orvakal Industrial Area. These principles/elements can be classified under the following tenets/categories:

- **Environment**: Under this category, global aspects related to Industrial Ecosystems in particular, and which are applicable to Orvakal region, as well as the site-specific issues outlined in the project understanding are proposed as focus areas of intervention.
- **Economic:** One of the key parameters for success of Orvakal Industrial area is evolving revenue maximising multi-product industrial clusters which are sustainable and compatible with overall industrial ecosystem in the region, inviting and attracting investors across industrial sectors.
- **Infrastructure:** Transportation and world class plug & play infrastructure are the lifelines for industrial development. Seamless connectivity becomes structural backbone for an industrial project. A coherent and hierarchical road and infrastructure network helps in appropriate functioning, phasing the development and even imageability of the area.
- **Design & Branding**: Key design and brand elements such as Quality of life, proximity to social amenities, and other design components that makes an Industrial area stand out from competitors, and recognizable to consumers and workers. These principles promote for the holistic socio-economic image of the industrial development.

Figure 3.1 – Project Vision

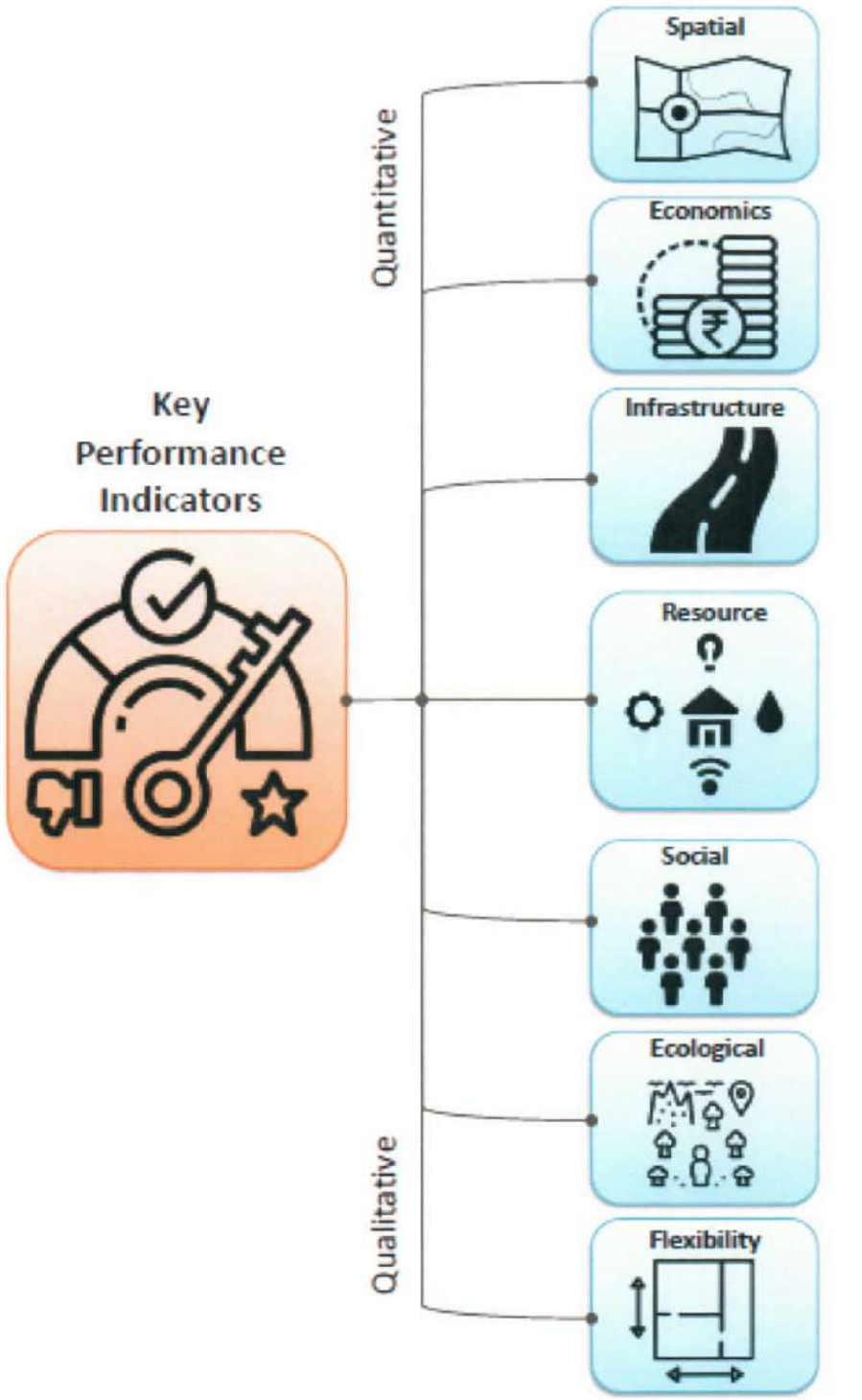


Source: Egis Analysis

3.2 - Key Performance Indicators

A Key Performance Indicator (KPI) is a quantitative value that shows how well a project is achieving its main goals. They are a set of quantitative indicators used by a project to assess and compare success in terms of satisfying strategic and operational objectives. Following are the KPIs proposed for Orvakal Industrial Area:

Figure 3.2 – Key Performance Indicators for Orvakal Industrial Area



Spatial Indicator to assess spatial distribution of different landuses, their efficiency in acreages and planning.

Broad assessment of cost – benefits from product-mix of industrial sectors achieved.

Truck infrastructure planning to evaluate their efficiency and network distribution to ensure seamless connectivity.

Resource indicators are used to weigh up the demand for water, energy, gas etc and efficient segregation and disposal of waste generated.

Social indicators are development performance at social level to evaluate achieved densities, populations etc

Ecological performance indicators show quality of open spaces, availability of open spaces to habitats or workers

Flexibility indicators assess the resilience to change or market demand like ease of plot amalgamation or subdivision.

Source: Egis Analysis

3.3 - Character Imagery

INDUSTRIAL

COMMERCIAL

RESIDENTIAL

RECREATIONAL SPACE

4

FINAL MASTERPLAN

4 - FINAL MASTERPLAN

4.1 - Introduction

This chapter details out the selected masterplan option for Orvakal Industrial Area in terms of its concept and various masterplan layers Additionally, this chapter contains the ROW sections and rendered views of all the proposed land parcels.

4.2 - Concept development

4.2.1 - Utilisation of Natural Features

The site's natural features, such as green vegetative cover, topography, nalas, streams, tree cover, protected forest, and so on, have been preserved to the greatest extent possible. Few ecological corridors that run across the site have been discovered and have been employed as primary guiding channels for design progress. The site's biological advantages were further integrated into the design through effective site planning and landscaping. Areas with a lot of trees have been preserved and will be turned into leisure zones. Site limitations, such as HT lines, electric pôles, steep contours etc. have been included throughout the design.

4.2.2 - Connectivity and Circulation

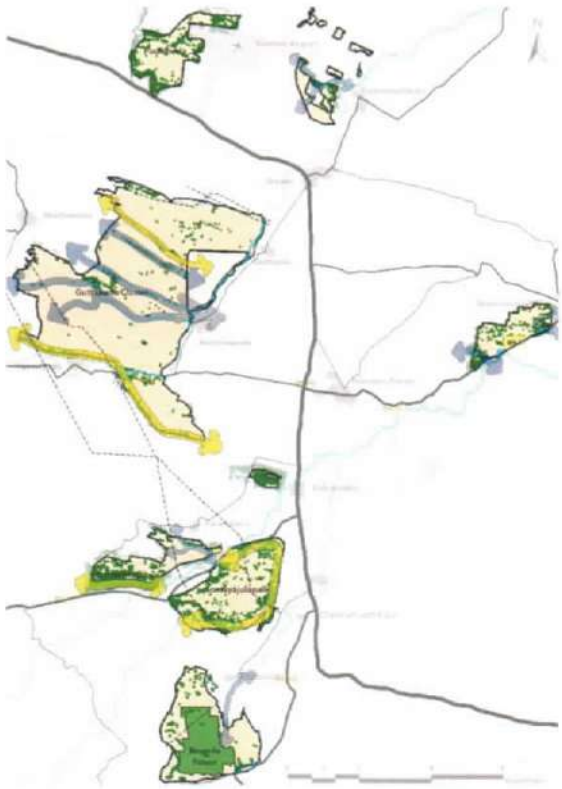
Because the existing NH40 serves as the major link between all of the site parcels, access points have been created to connect them. From NH40, 13 access locations have been found. It has been recommended that the existing village roads in and around the property parcels be expanded further to serve as alternate links to the site. The internal road system within the site parcels is built as a loop, with subsidiary roads emanating from the larger loops.

4.2.3 - Functional Distribution

A mixed-use approach with specialised industries has been followed wherein the heavy industrial zones are clearly segregated from the residential or other non-industrial zones with the use of minimum buffers. The functions have been distributed based on the ease of access and in terms of their inter connectivity and interdependencies with each other and with the surroundings. Various anchor points have been proposed to give the site parcels an identity and imageability.

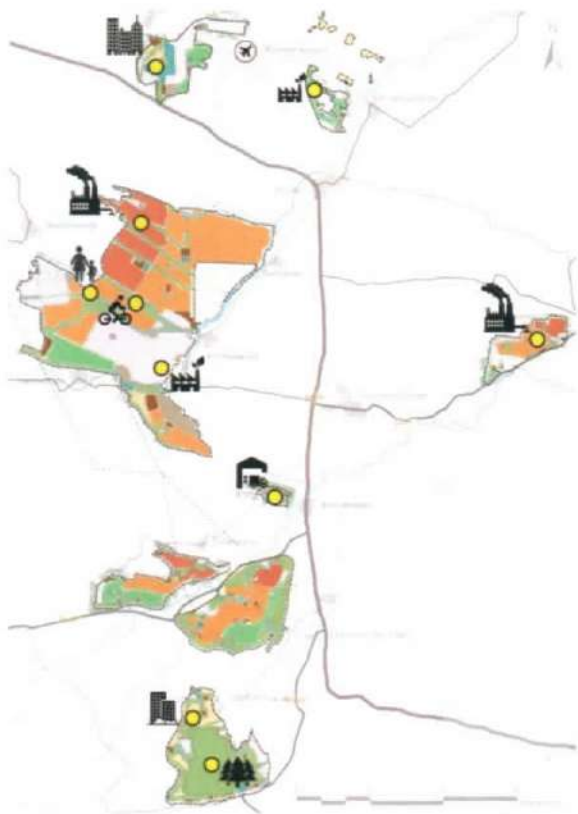
Figure 4.1 – Option 1 Broad Moves

Utilisation of Natural Features



Connectivity and circulation

Functional Distribution



Source: Egis Analysis

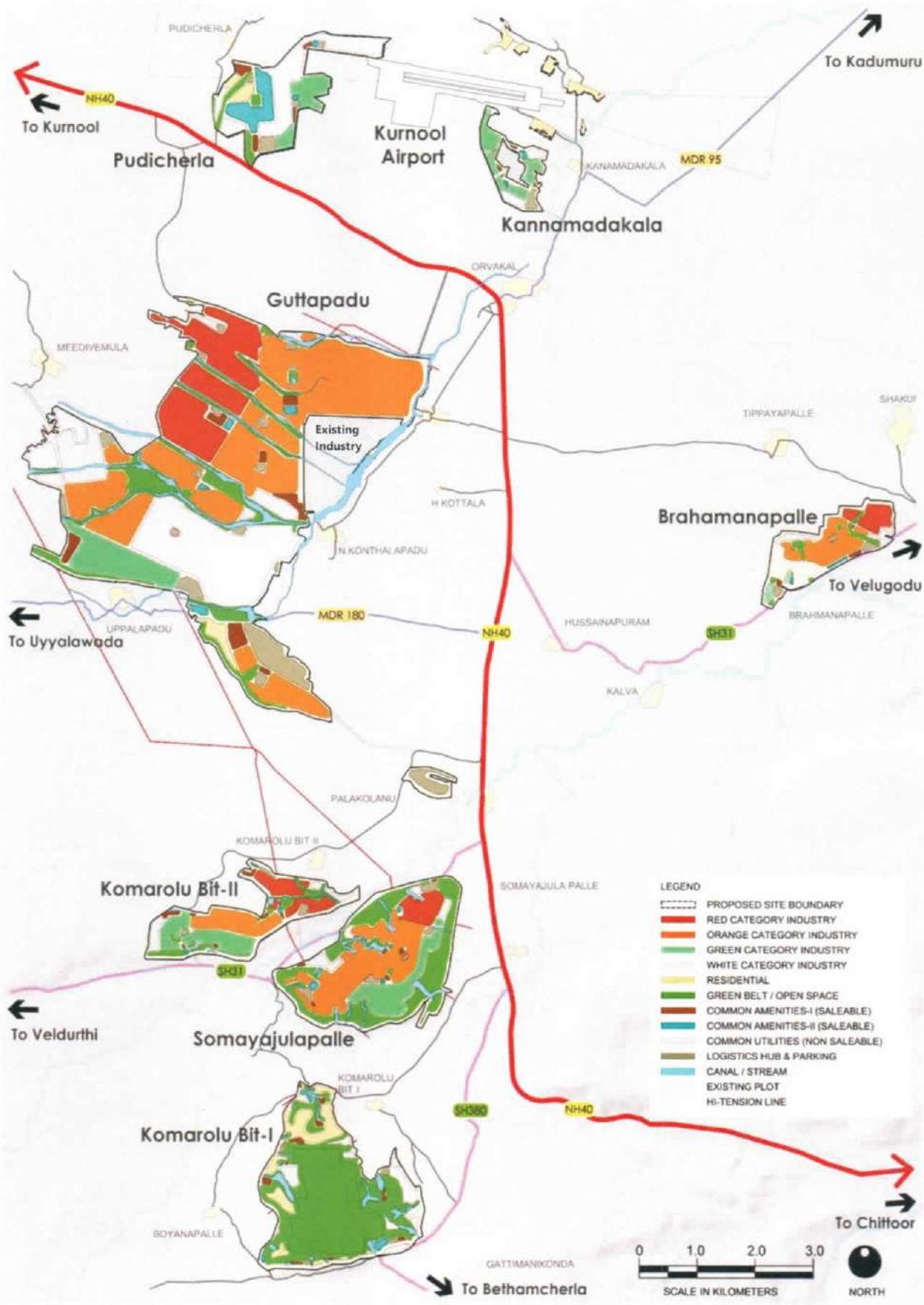
4.3 - Zoning Plan

The final masterplan is based on the concept of specialised clustering with a mix of industries wherein there is a clear segregation between the industrial and non - industrial uses. The zoning has been done in a manner as in understanding and utilizing the site constraints in the best possible manner. Some of the key principles are –

- Environmental features to serve as green connections between two non-conforming zones
- Segregation of movement linkages as per the proposed functional zones
- Zones have been defined in consideration to the surrounding landuses

The PSP amenities have been positioned in a way that they form important nodes within the parcels and are located at a walking distance from the surrounding zones. They also act as usable buffer between either two zones with different categories of industries or between non industrial and industrial zones The residential zones have been strategically located away from the heavy industries and closer to the existing reserved forest in the southernmost parcels and in the northern parcels situated within the airport funnel zone. the workers residential zone has been located within the parcel with a higher percentage of industries considering the walk to work concept.

Figure 4.2 – Zoning Plan



Source: Egis Analysis

4.4 - Structure Plan

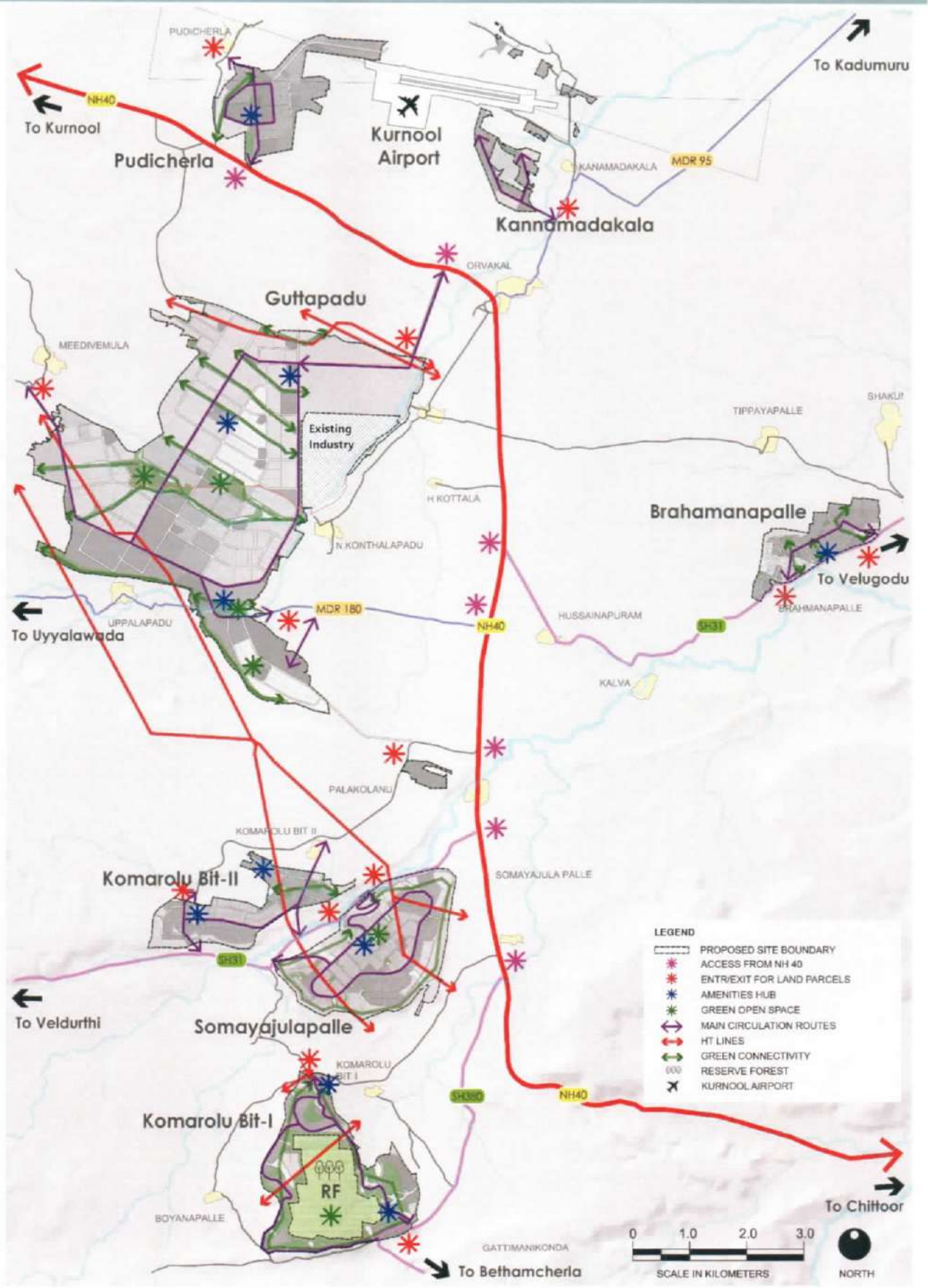
The plan has been structured in a clustered form. The heavy industries have been clustered together away from the residential land uses, which has the following benefits:

- The industrial discharge can be treated at one place
- Seamless truck movement within the cluster
- Less environmental hazard and pollution near residential land uses

The positioning of the functional areas within the final design concept shows a careful approach to the existing natural elements. The existing streams and forest cover provide green recreational links between diverse users. The bigger green areas are devoted landmark public zones. The facilities have been strategically placed at key intersections and interspersed across various landuses, creating public nodes that encourage interaction areas for good social bonding as well as commercial interfaces for economically sustainable expansion and growth. It has also been carefully considered to incorporate the existing HT lines in the design development process, and appropriate buffers have been suggested for them. The HT line buffers have been incorporated with the green connections that have been planned.

In conjunction with a well-integrated circulation pattern, the hierarchical transport network creates a strong movement structure that ensures accessibility and porosity across the site, with separated entrances and transit routes for industrial and non-industrial uses.

Figure 4.3 – Structure Plan



Source: Egis Analysis

4.5 - Landuse Plan

The landuse plan depicts that industrial landuse consumes major portion of the total site area. The parcels of Guttapadu, Brahmanapalle, Somayajulapalle and Komarolu Bit II have the maximum plots for heavy industries.

Within the northern cluster of Pudicherla and the southernmost parcel of Komarolu Bit I, the residential zone has been carefully combined with a few small industrial plots. There are enough buffers around the existing protected forest in Komarolu Bit I, which have been split into LIG, MIG, and HIG residential plots, and few PSP and light industrial plots. Pudicherla in the north has been suggested as a location for a business hub owing to easy access from NH40. Light industries, commercial usage, and residential use are all that may be done at Pudicherla and Kannamadakala since they are located inside the airport funnel zone. The workers residential colony is located within the Guttapadu cluster to support the concept of walk to work.

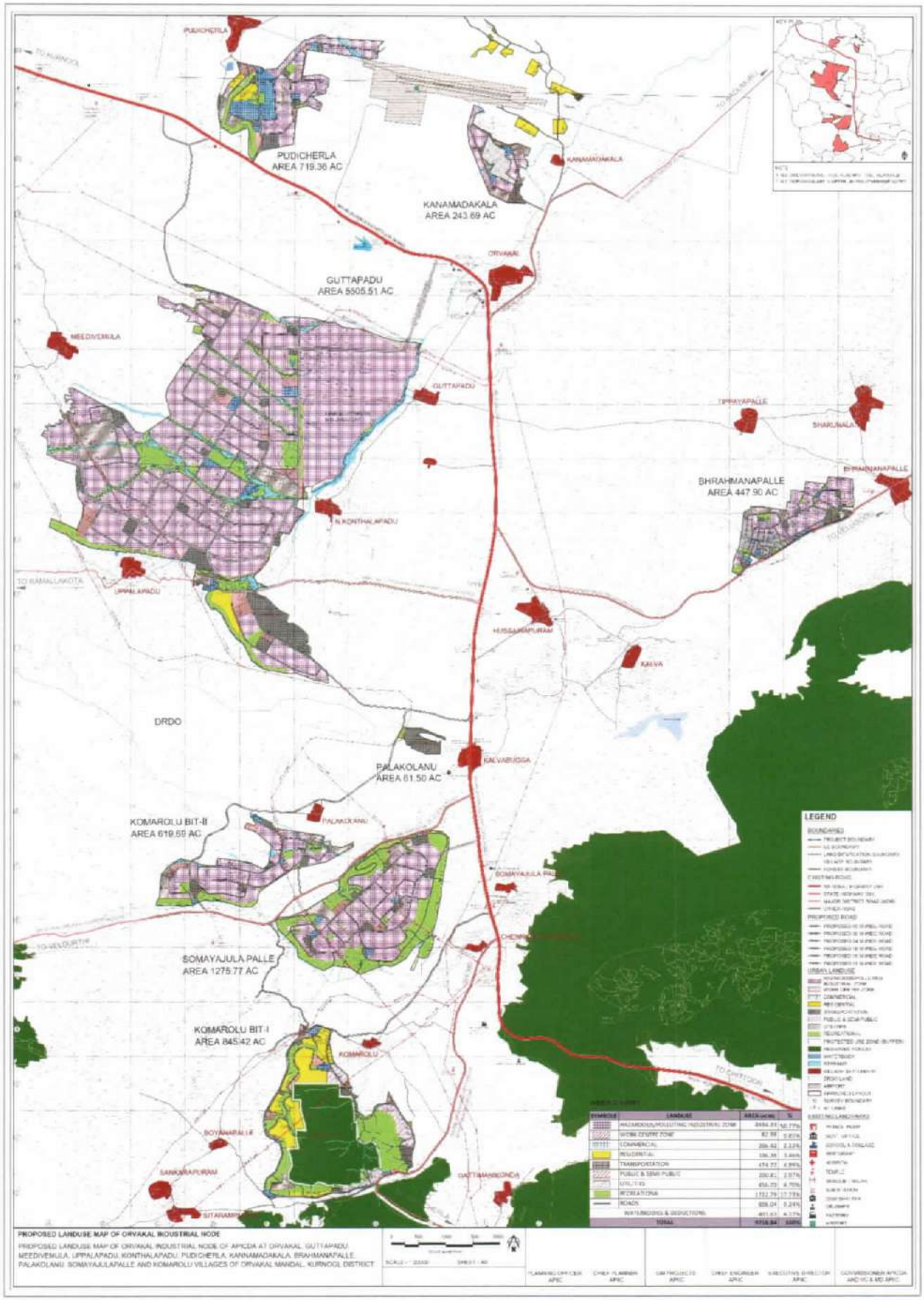
Palakolanu has been designated as a logistics hub owing to its closeness to NH40 and strategic location between Guttapadu and Somayajulapalle. Each parcel has a small area devoted to logistics. The plots dedicated to Amenities and utilities have been located in such a way that they form important nodes for its surrounding landuses.

Table 4.1– Land Use Area and Percentage Distribution

Landuse	Area in Acres	% Of Site Area
Industrial- Hazardous/Polluting Zone	4934.33	50.77%
Industrial Work center zone	82.98	0.89%
Commercial	206.42	2.22%
Residential	336.36	3.61%
Transportation	474.77	5.10%
Public & semi-public	200.81	2.16%
Public utilities	456.70	4.91%
Roads	898.04	9.65%
Recreational	1212.61	13.03%
Protected Green (Stream, HT and Site Buffers)	510.18	5.48%
Protected Blue (Waterbodies & area deductions)	405.63	4.36%
Total site area	9718.84	**100.00%**

Source: Egis Analysis

Figure 4.4 – Landuse Plan



Source: Egis Analysis

4.6 - Industry Category Plan

The industries have been categorised in red, orange, green and white industries. The purpose of categorization is to ensure that the industry is established in a manner which is consistent with the environmental objectives.

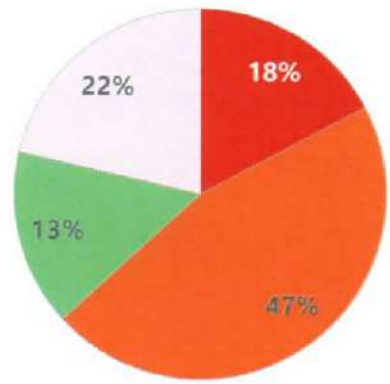
The red and orange industries have been clearly separated from the residential zone in this alternative. The green open areas serve as a buffer between two non-compliant activities as well as act as interconnections between the residential. PSP and industrial plots. PSP and utility plots have been evenly divided throughout the parcels.

In terms of proposed industrial uses, the red and orange (highly polluting) industries have been located within the clusters of Guttapadu, Somayajulapalle, Komarolu Bit II and Brahmanapalle. The heavy / anchor industries with larger plots are proposed within the Guttapadu cluster with smaller plots for green and white industries. The logistics and the majority of the commercial plots have been located at the entry points of the parcels for easy access from the NH and SH.

Table 4.2–Proposed Industrial Area Statement

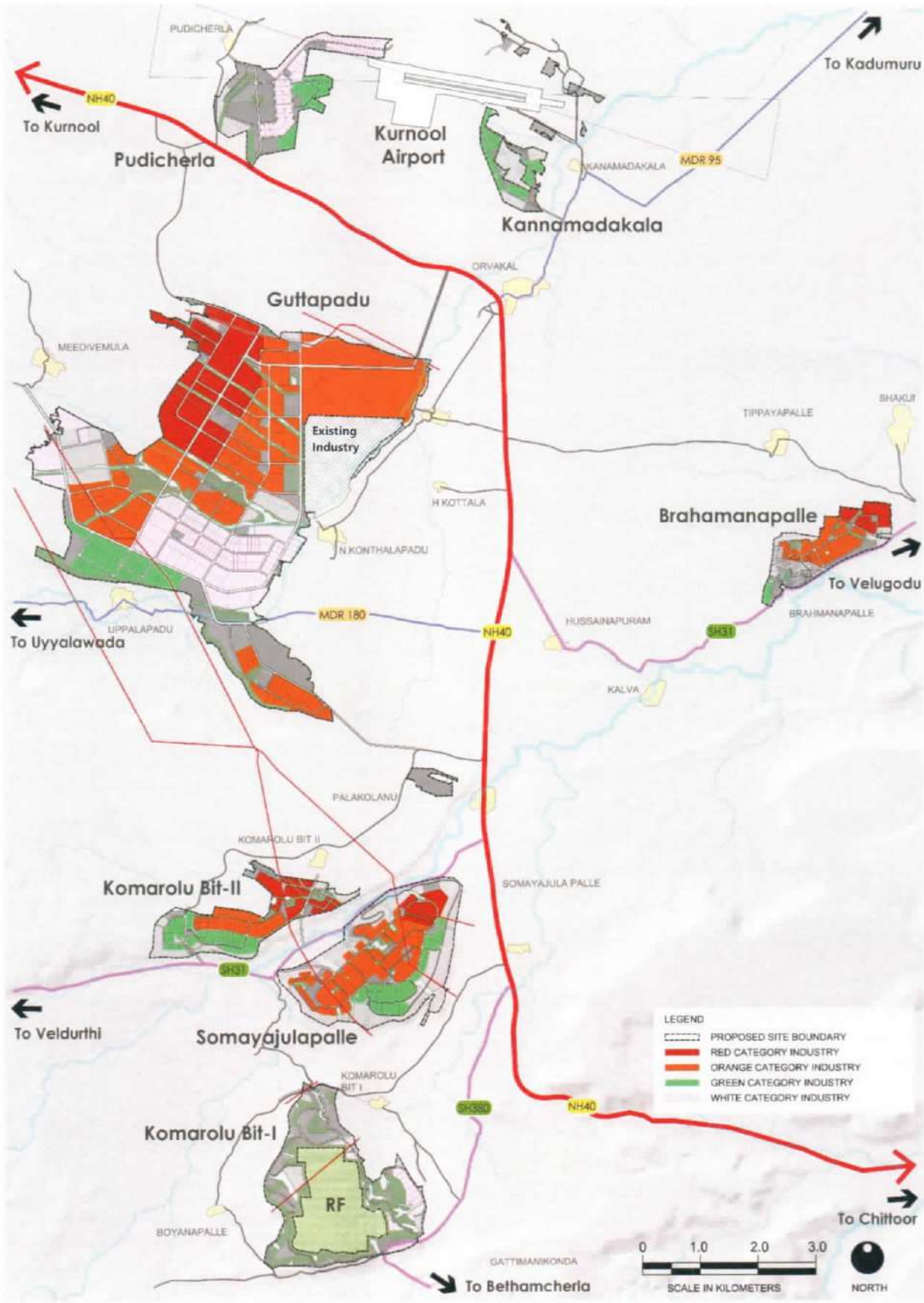
Landuse	Area in Acres	% Of Site Area
RED CATEGORY INDUSTRY	832.60	18.08%
ORANGE CATEGORY INDUSTRY	2160.67	46.93%
GREEN CATEGORY INDUSTRY	615.31	13.36%
WHITE CATEGORY INDUSTRY	995.54	21.62%
TOTAL INDUSTRIAL AREA	**4604.12**	100%

Figure 4.5 – Industrial Area Percentage Distribution



Source: Egis Analysis

Figure 4.6 – Industry Categorisation Plan



Source: Egis Analysis

4.7 - Sectorwise Categorisation Plan

The suggested industrial classification is based on the specialised mix of industries within each parcel. While categorising the industries, the EC-based industries permitted within the Guttapadu cluster were also taken into consideration. Residential landuses have been suggested on the lots of Pudicherla, Kannamadakala, and Komarolu Bit I, thus these parcels include white industries and a few green industries. Kannamadakala houses the Food and Beverage industries which comes under the white industry category. Pudicherla consists of a combination of light industry and MICE landuses. Komarolu Bit I includes few white industries along with the proposed residential landuses.

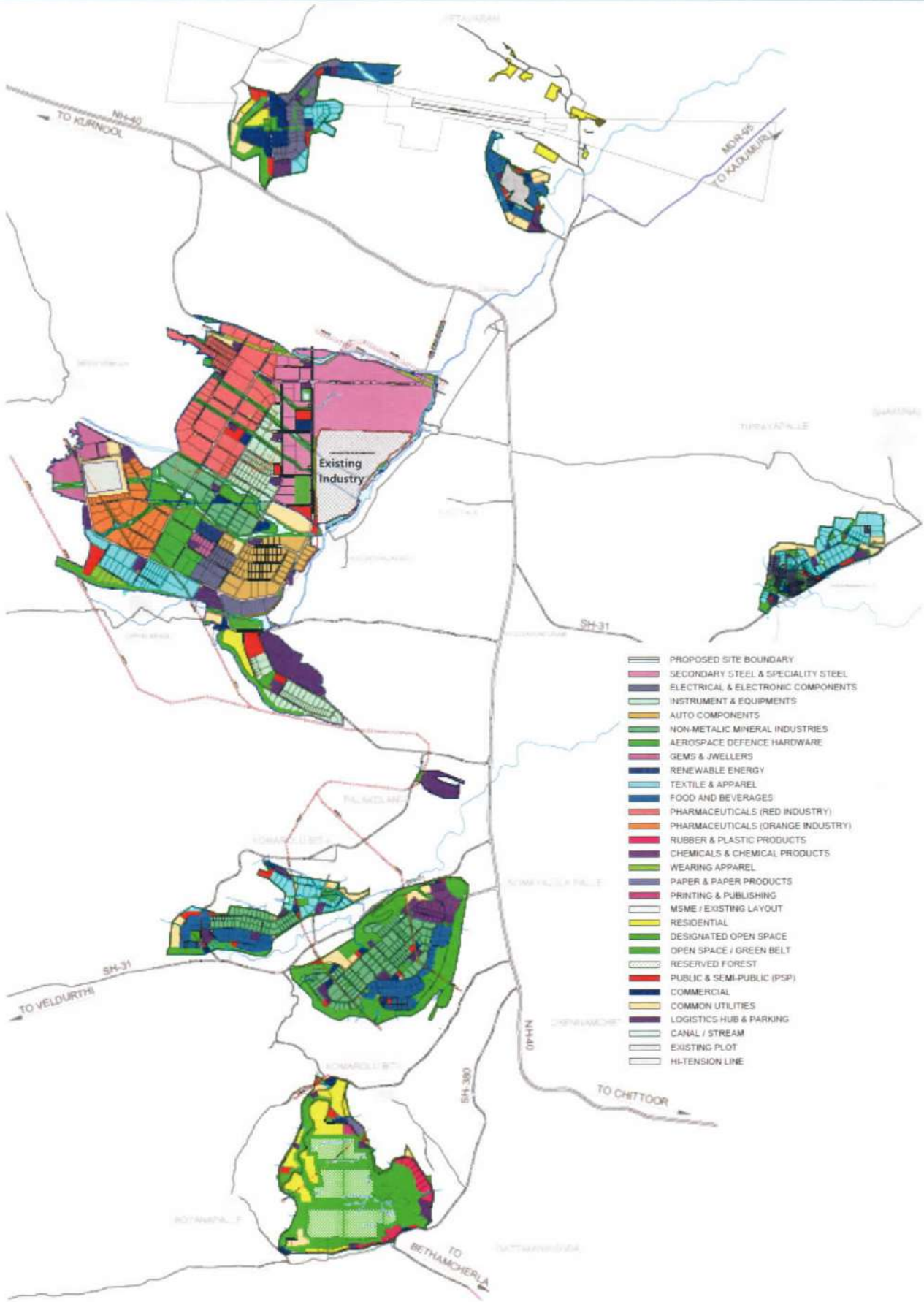
The northern APIIC zone of the Guttapadu cluster is intended to include pharmaceuticals and their associated pharmaceutical formulations, as well as certain specialised steel-based industries to the east and a large logistic centre alongside. The southern NICDC zone has a combination of light and heavy industries, with heavy industries near the summer storage tank on the west while textile, food and beverage, and light engineering industries towards the cluster's southern tip. Guttapadu's authorised EC-based industries are situated in the same region as those originally planned. Textile industries are planned inside the Brahmanapalle land parcel. The Komarolu Bit-II land parcel has been suggested for non-metallic mineral industries, as well as food and beverage and textile industries, while the Somayajulapalle land parcel has been proposed for chemical and associated product industries, as well as non-metallic industries.

Table 4.3– Industrial sector-based Area Statement

Landuse	Area in Acres	% Share
SECONDARY STEEL & SPECIALITY STEEL	807.76	8.31%
ELECTRICAL & ELECTRONIC COMPONENTS	265.33	2.73%
INSTRUMENT & EQUIPMENTS	328.01	3.37%
AUTO-COMPONENTS	272.66	2.81%
NON-METALIC MINERAL INDUSTRIES	644.23	6.63%
AEROSPACE DEFENCE HARDWARE	148.86	1.53%
GEMS & JEWELLERY	149.43	1.54%
[illegible]	25.24	0.26%
TEXTILE & APPAREL	552.38	5.68%
FOOD AND BEVERAGES	379.25	3.90%
PHARMACEUTICALS (RED INDUSTRY)	574.74	5.91%
PHARMACEUTICALS (ORANGE INDUSTRY)	264.22	2.72%
RUBBER & PLASTIC PRODUCTS	63.44	0.65%
CHEMICALS & CHEMICAL PRODUCTS	84.61	0.87%
WEARING APPAREL	24.42	0.25%
PAPER & PAPER PRODUCTS	11.01	0.11%
PRINTING & PUBLISHING	8.53	0.09%
[illegible]	474.77	4.89%
RESIDENTIAL	336.36	3.46%
BUSINESS CENTER	89.48	0.92%
COMMERCIAL	116.94	1.20%
COMMON AMENITIES (PSP)	200.81	2.07%
COMMON UTILITIES	456.7	4.70%
ROAD	898.04	9.24%
GREEN	1722.79	17.73%
WATERBODIES / STREAMS & AREA DEDUCTION	405.63	4.17%
EXISITING INDUSTRY- JAI RAJ ISPAT LTD	413.19	4.25%
TOTAL	**9718.84**	100.00%

Source: Egis Analysis

Figure 4.7 – Sector wise Categorisation Plan



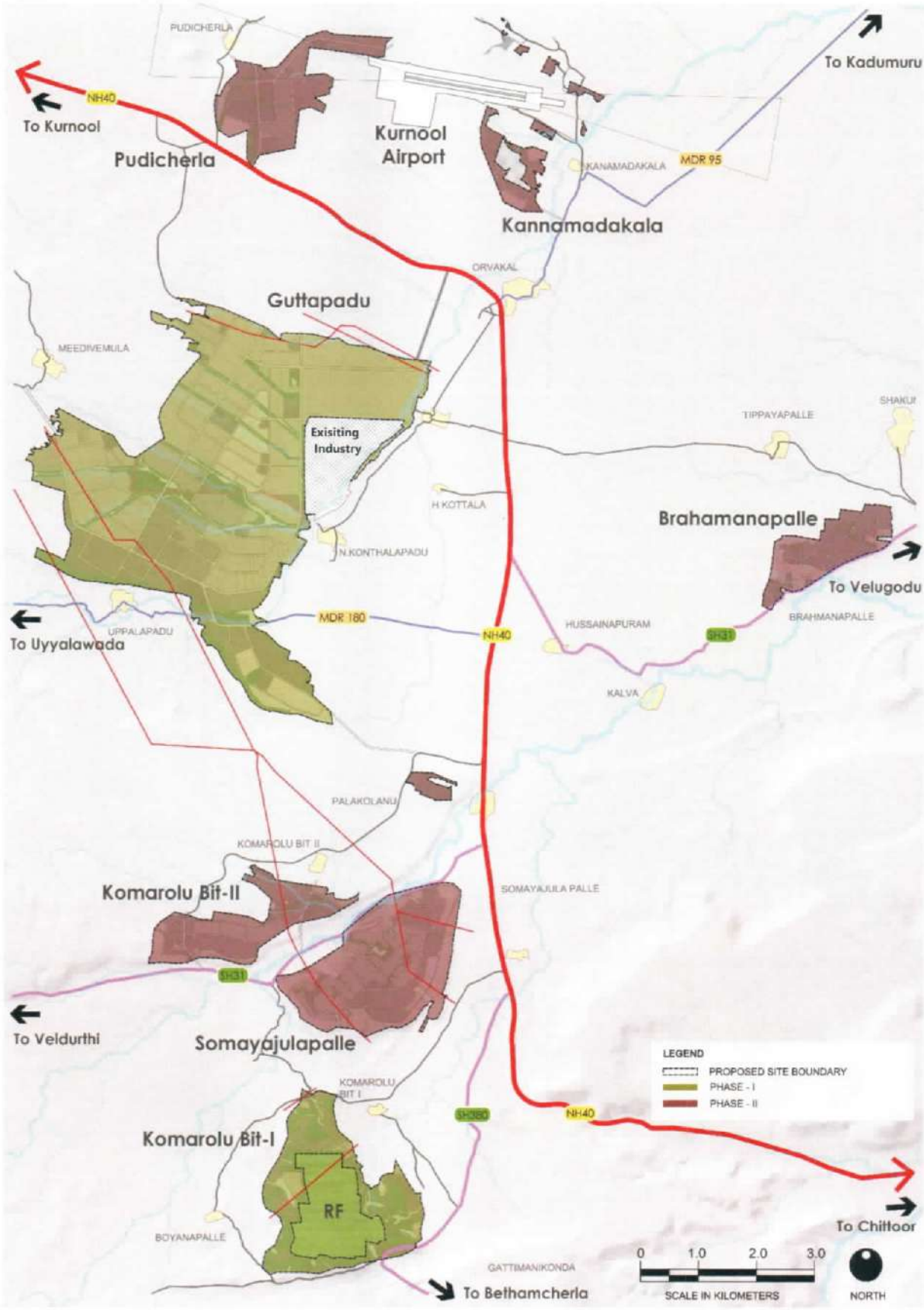
Source: Egis Analysis

4.8 - Phasing Plan

The phasing plan has been established with the importance of the linking highways as well as the land parcels at the forefront of consideration. The entire project work has been divided into two phases. The development of Komarolu Bit I and the Guttapadu cluster are included in the first phase of the project. The Guttapadu cluster is split into two zones: the northern zone, which is under the administration of APIIC, and the southern zone, which is under the administration of NICDC. During the first phase, both zones will be developed in parallel with one another. Due to the presence of a conserved forest and difficult terrain, Komarolu Bit I has also been included in the first phase of construction. The planned access roads to these clusters will be constructed in tandem with the clusters.

Second phase development covers the remaining planned clusters, which are Pudicherla, Kannamadakala, Brahmanapalle, Komarolu Bit II, Somayajulapalle, and Palakolanu. The second phase will take care of any leftover development in Guttapadu, and Komarolu Bit I that has not been completed. The accompanying facilities and utilities, among other things, will be phased away in the same manner.

Figure 4.8 – Phasing Plan



Source: Egis Analysis

4.9 - Road Hierarchy

The planned road network considers existing site limitations and anticipated land uses. They have been designed to facilitate mobility within land parcels. Internal roads have been suggested in a hierarchical structure with ROWs of 45M, 30M, 24M, and 18M. Road connection has been planned in a loop system throughout all eight clusters to guarantee access to all intended land uses.

Numerous entry/exit points from existing National and State highways have been proposed. Guttapadu is the site's largest parcel and four access points have been identified, the main one being from NH40 to the north through an existing village road that requires further development. Two direct access points have been discovered from MDR180, which is now traversing the cluster. The fourth entry point is on Meedivemula's northwest flank. Two entry points have been identified in Pudicherla. The main entrance is directly accessible via NH40. The alternative access road requires development to improve its current state and connection to MDR95. Kannamadakala is accessible from MDR95 through an existing road that will be improved, and the current village roads connecting the dispersed land pockets will also be renovated. Brahmanapalle has been identified as having a single direct route from SH31.

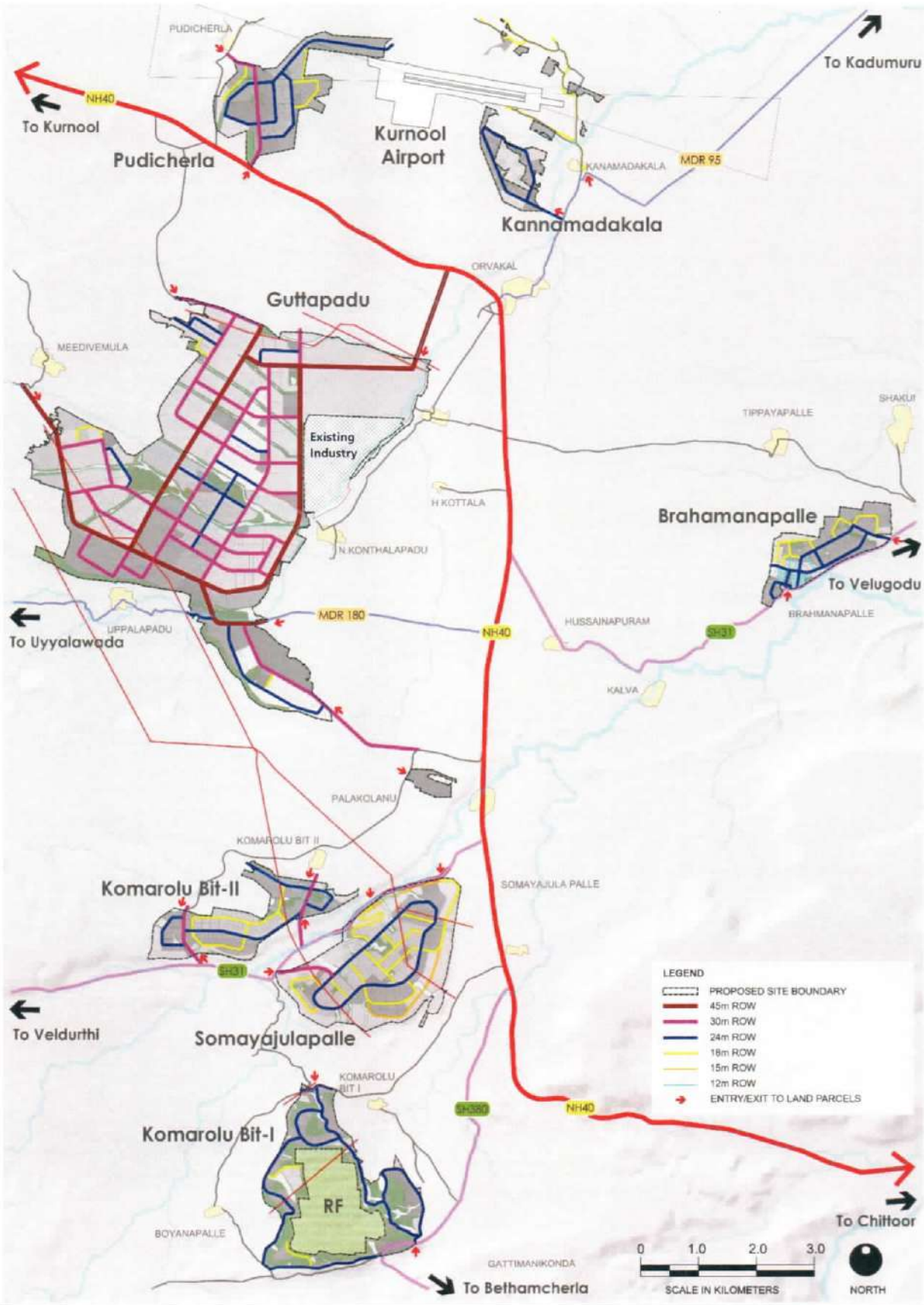
Komarolu Bit II and Somayajulapalle both have direct access from SH31 via a single road. Komarolu Bit I has two access points, one on the north from a village road that links to NH40 and the other on the south from SH-380 that serve as approach roads to the southern portions of this land parcel. 45M roads have been planned as the primary spine inside the Guttapadu cluster, with 30m ROW branching out from it. Residential plots are accessible by planned 30M and 24M ROW roadways.

Table 4.4 – Proposed Roads Details

LAND PARCEL	PROPOSED ROW (IN MTRS)						TOTAL
	45 MTRS	30 MTRS	24 MTRS	18 MTRS	15 MTRS	12 MTRS	
Guttapadu	19030	31180	10631	1723			**62564**
Pudicherla		2102	6618	2586			**11306**
Kannamadakala			3610				**3610**
Brahmanapalle			3853	2859		482	**7194**
Somayajulapalle	85	1028	6088	11172	3634		**22008**
Komarolu Bit – I		367	13274	429			**14070**
Komarolu Bit - II		1504	5450	3958			**10912**
Total	**19115**	**36182**	**49524**	**22728**	**3634**	**482**	**131665**
%	**14.52%**	**27.48%**	**37.61%**	**17.26%**	**2.76%**	**0.37%**	**100.00%**

Source: Egis Analysis

Figure 4.9 – Road Hierarchy



Source: Egis Analysis

4.10 - Internal Mobility and Circulation Plan

4.10.1 - Public Transit Plan

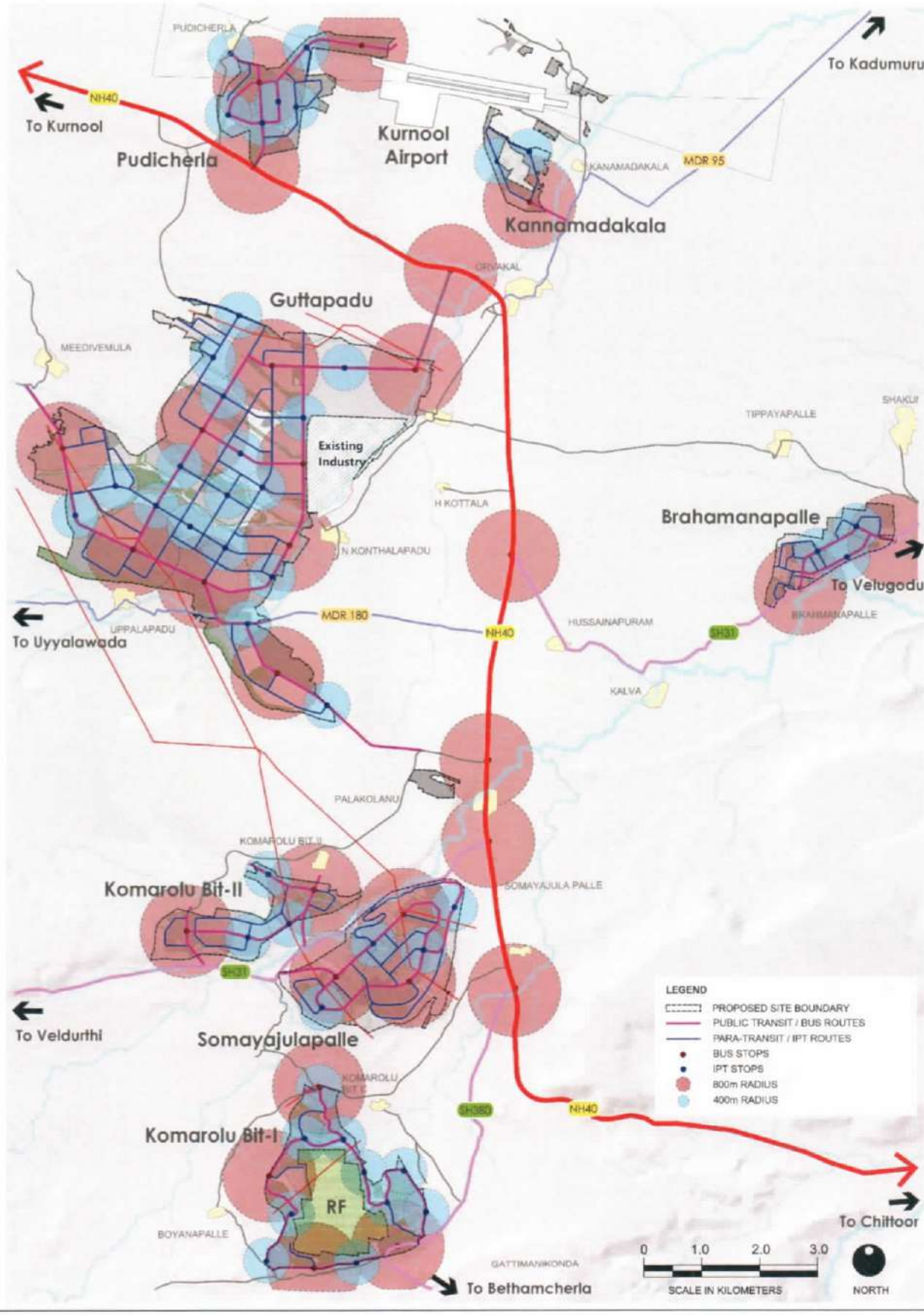
The circulation network is an important element of the design, ensuring the site's accessibility and porosity. Separate vehicle loops have been created for industrial and residential traffic. The walk-to-work idea has been implemented via the addition of pedestrian walkways, bike lanes on all major highways, and shaded, walkable green corridors that cut across land uses and link places of employment, stay, and recreation. Provision of car, auto and cycle share has been proposed near the bus stops.

To facilitate comprehension, the plan in figure 5.13 depicts the public transit route (bus route) and the paratransit route in different layers. The bus stops are located within an 800-metre radius, whereas the IPT stops are located within a 400-metre radius, which is a walkable distance. The public transit networks (buses, e-rickshaws, etc.) span the whole site, providing maximum coverage on the main 45m and 30m roadways in both industrial and non-industrial sectors. Loops for LCVs have been established along 24m and 18m roadways, mostly in medium and light industrial sectors. These would serve small/allied enterprises that do not need large commodities transportation.

Figure 4.10 – Reference Images for Public Transit

Source: Egis Analysis

Figure 4.11 – Public Transit Plan



Source: Egis Analysis

4.11 - Open Space Plan

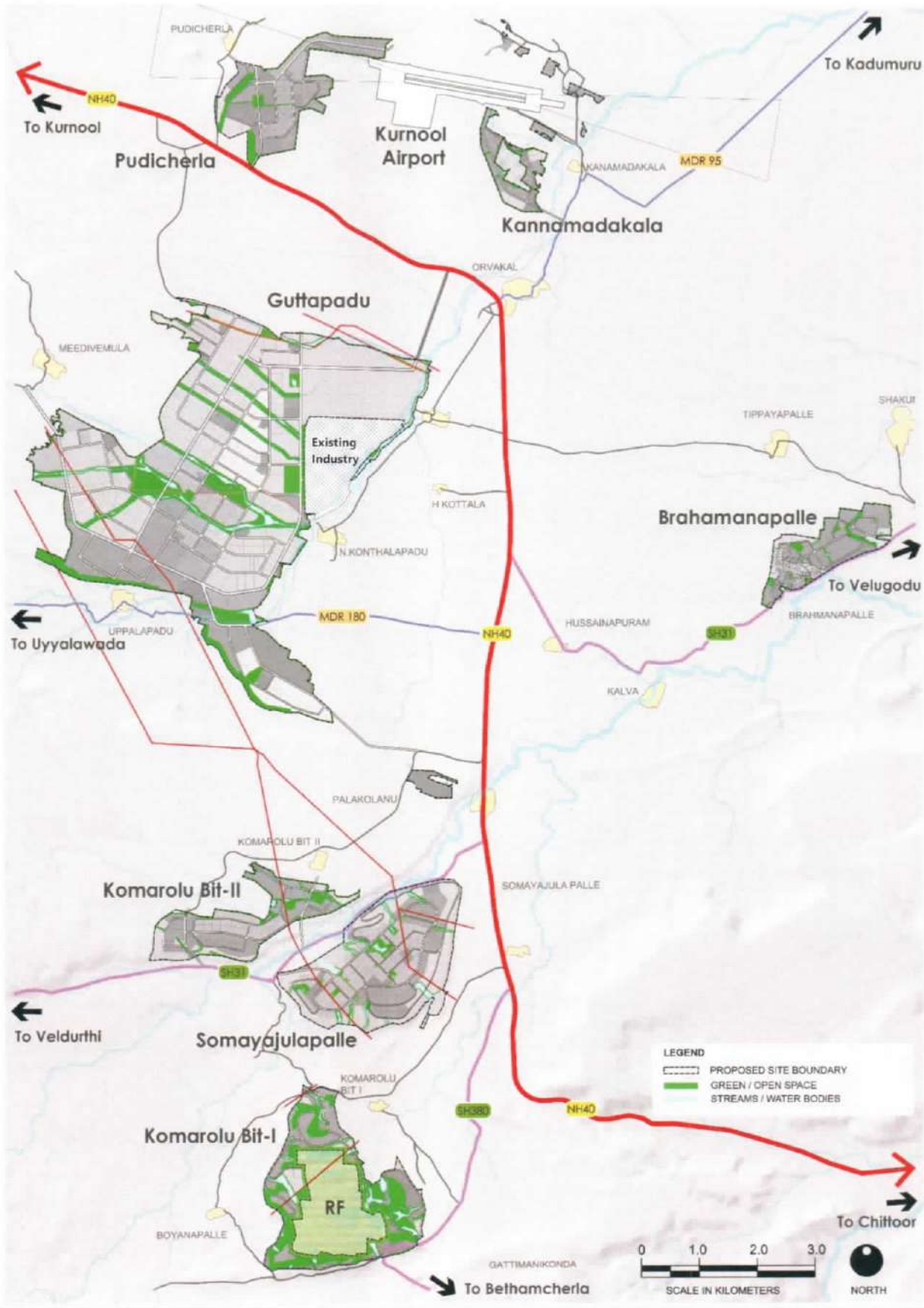
The site's primary feature is a network of green open spaces created by preserving existing water bodies, streams, green vegetative cover, and natural topography that interweave to create fascinating public interaction areas. Existing streams served as the starting point for design evolution. The different types of open spaces suggested, include buffers for high-tension lines, buffers for streams and bodies of water, and designated open spaces. The planned green buffers around the streams will aid in not only protecting the streams from other land uses, but also in retaining water on the property. The areas with the highest tree cover have been classified as designated recreational space. These areas will serve as breathing spaces, uniting the diverse land uses to provide a common meeting place for the public. Additionally, the green buffers and recreational areas are created as green connections that run across the land parcels, connecting the different open spaces and purposes.

Table 4.5 – Proposed Open Space Details

LANDUSE	SOCIAL GREEN	DESIGNATED OPEN SPACE	OTHER OPEN SPACE	SITE BUFFER	STREAM BUFFER	HT BUFFER	TOTAL	% SHARE (PARCEL WISE)
Guttapadu								
Area (in Acres)		248.06	175.73	96.55	88.37	75.16	**683.87**	**13.43%**
No. Of Plots		19						
Pudicherla								
Area (in Acres)	49.24	15.52	9.27	37.61	4.43		**116.07**	**16.14%**
No. Of Plots		5						
Kannamadakala								
Area (in Acres)			1.68	26.62	3.65		**31.95**	**13.11%**
No. Of Plots			7					
Brahmanapalle								
Area (in Acres)		19.02	5.12	21.79	4.86		**50.79**	**11.34%**
No. Of Plots		10						
Somayajulapalle								
Area (in Acres)	311.65	52.45	10.89	34.70	6.82	25.46	**441.97**	**34.64%**
No. Of Plots		12						
Komarolu Bit - I								
Area (in Acres)	223.76	24.87	3.44	22.68	6.91	2.99	**284.65**	**33.67%**
No. Of Plots		6						
Komarolu Bit - II								
Area (in Acres)	38.51	20.43	2.97	34.31	12.69	4.59	**113.50**	**18.32%**
No. Of Plots		5						
Total	**623.16**	**380.35**	**209.1**	**274.26**	**127.73**	**108.2**	**1722.8**	**18.51%**
%	**36.17%**	**22.08%**	**12.14%**	**15.92%**	**7.41%**	**6.28%**	**100.00%**	

Source: Egis Analysis

Figure 4.12 – Open Space Plan



Source: Egis Analysis

4.12 - Public and Semi-Public Amenities

Public semi-public usage encompasses the amenities and facilities needed to maintain and improve the living standards of inhabitants and workers. The primary uses include the provision of educational institutions such as schools, colleges, and anganwadis, as well as medical facilities such as hospitals and dispensaries, as well as services such as fire stations, petrol pumps, police stations, and ATMs, as well as recreational areas such as sports centres and essential services such as public toilets.

The shared amenities – I (PSP) have been distributed in the form of nodes across the project site. These facilities have been designated to coexist with common amenities – II (commercial), thus creating an agglomeration and maximising the use of infrastructure supplied. They are scattered across industrial and non-industrial zones, each with its own unique personality based on its location and surrounding functions. Thus, these discrete spaces would aggregate to create a network of critical gathering spaces in the design for human interaction, eventually transforming into buzzing activity hubs.

4.12.1 - Proposed Residential PSP / Amenities

Table 4.6 – Proposed Residential PSP

AMENITIES	GUTTAPADU (NICDC)	PUDICHERLA (APIIC)	KANNAMADAKALA (APIIC)	KOMAROLU BIT – I (NICDC)	TOTAL
Education					
Pre Primary, Nursery School	3	2	5	5	15
Primary School (class I to V)	1	1	2	2	6
Senior Secondary School (VI to XII)	1	0	1	1	3
Community Areas					
Anganwadi - Housing area/ cluster	1	1	2	2	6
Community Room	1	1	2	2	6
Burial Grounds	1	0	0	1	2
Commercial/Retail					
Convenience Shopping	1	1	2	2	6
Services					
LPG Godown	1	1	2	2	6
Sub fire post & Remote subscriber unit	1	1	2	2	6
Bank/ ATM	1	1	2	2	6
Green/Open					
Cluster	1	1	2	2	6

Source: Egis Analysis

Table 4.7 – Residential PSP Nos. and Areas

LAND PARCEL	RESIDENTIAL PSP NOS.	RESIDENTIAL PSP AREAS
Guttapadu (NICDC)	11	6.87
Guttapadu (APIIC)	0	0.00

Table 4.7 – Residential PSP Nos. and Areas

LAND PARCEL	RESIDENTIAL PSP NOS.	RESIDENTIAL PSP AREAS
Pudicherla (APIIC)	9	2.22
Kannamadakala (APIIC)	20	9.09
Brahmanapalle (APIIC)	0	0.00
Palakolanu (APIIC)	0	0.00
Somayajulapalle (NICDC)	0	0.00
Komarolu Bit – I (NICDC)	20	9.09
Komarolu Bit - II (APIIC)	0	0.00
Total No. Of PSP/Amenities	**60**	
Total Area (Acres)		**27.27**

Source: Egis Analysis

4.12.2 - Proposed Industrial PSP / Amenities

Table 4.8 – Proposed Industrial PSP

AMENITIES	GUTTAPADU (NICDC)	GUTTAPADU (APIIC)	PUDICHERLA (APIIC)	SOMAYAJULA PALLE (NICDC)	KOMAROLU BIT – I (NICDC)	KOMAROLU BIT - II (APIIC)	BRAHMANAPALLE	TOTAL
Institutional								
Skill development Centre	1	0	1	0	0	0	0	**2**
Pollution control Labs	1	0	0	0	0	0	0	**1**
Human Resource development Centre	1	0	0	0	0	0	0	**1**
Telecommunication Centre	5	2	4	1	1	0	0	**13**
Industrial training centre	3	1	3	1	0	0	0	**8**
Medical								
Dispensary	3	1	3	1	0	0	0	**8**
Diagnostic centre	1	0	0	0	0	0	0	**1**
Community Areas							0	
Communication centres	2	1	2	0	0	0	0	**5**
Training centres	2	1	2	0	0	0	0	**5**
Commercial/Retail								
Local Area Offices	1	0	0	0	0	0	0	**1**

Table 4.8 – Proposed Industrial PSP

AMENITIES	GUTTAPADU (NICDC)	GUTTAPADU (APIIC)	PUDICHERLA (APIIC)	SOMAYAJULAPALLE (NICDC)	KOMAROLU BIT – I (NICDC)	KOMAROLU BIT - II (APIIC)	BRAHMANAPALLE	TOTAL
Convenience Shopping	2	1	2	0	0	0	0	**5**
Electrical Goods, spare parts, Accessories shops	1	0	0	0	0	0	0	**1**
Repair Service Packaging, Labelling & Courier	1	0	0	0	0	0	0	**1**
Electrical Goods shops	1	0	0	0	0	0	0	**1**
Services								
LPG Godown	2	1	2	0	0	0	0	**5**
Police post	2	1	2	0	0	0	0	**5**
Sub fire post & Remote subscriber unit	2	1	2	0	0	0	0	**5**
Fire station	1	0	0	0	0	0	0	**1**
Bank/ ATM	10	5	9	3	2	1	1	**32**
General Post Office	3	1	3	1	0	0	0	**8**
Public Toilet	3	1	3	1	0	0	0	**8**
Green/Open								
Neighbourhood	3	1	3	1	0	0	0	**8**
Community Green	5	2	4	1	1	0	0	**13**
TOTAL	**56**	**20**	**45**	**7**	**4**	**1**	**1**	

Source: Egis Analysis

Table 4.9 – Residential PSP Nos. and Areas

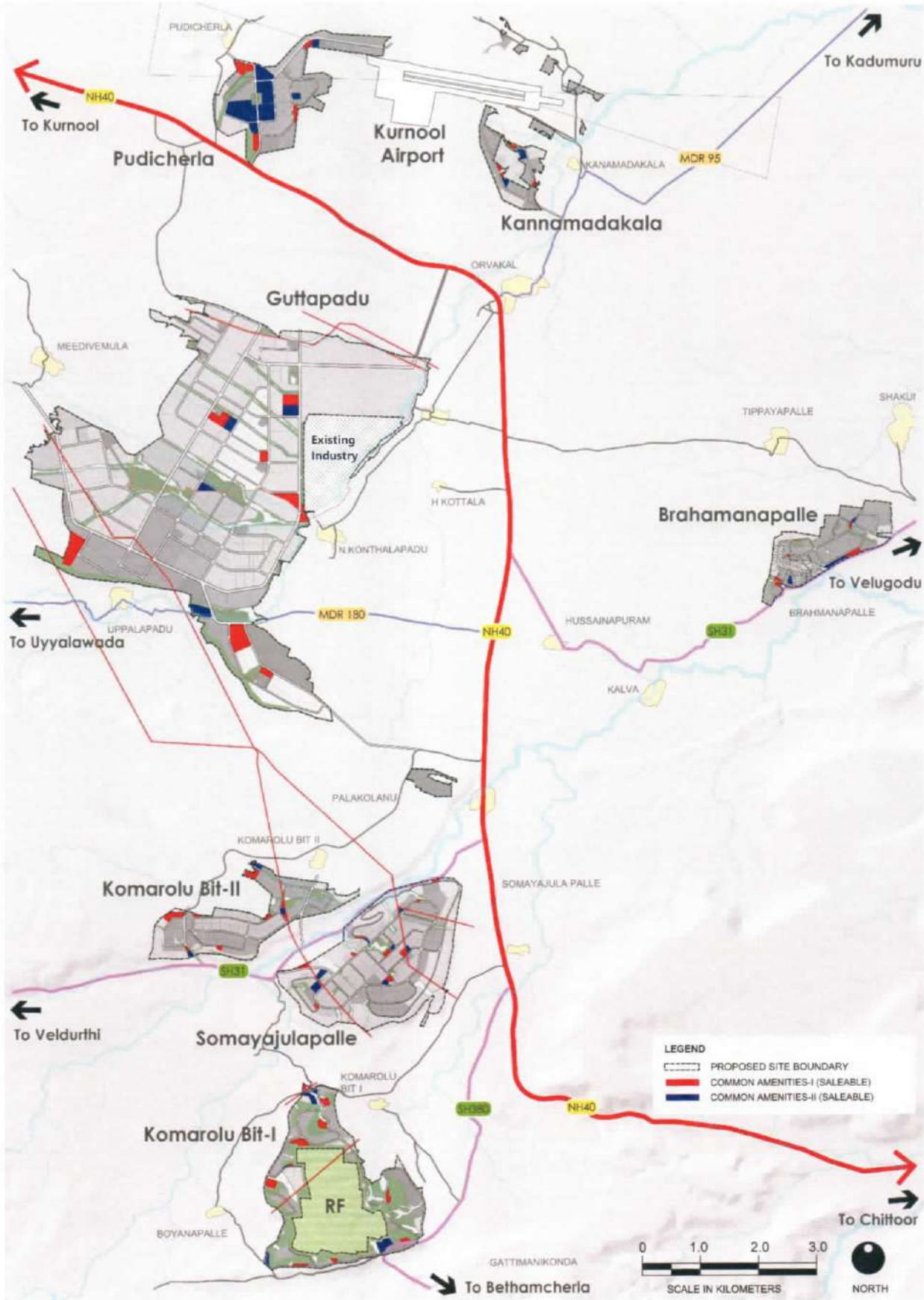
LAND PARCEL	INDUSTRIAL PSP NOS.	INDUSTRIAL PSP AREAS
Guttapadu (NICDC)	48	77.69
Guttapadu (APIIC)	17	24.19
Pudicherla (APIIC)	38	54.05
Kannamadakala (APIIC)	0	0.00
Brahmanapalle (APIIC)	1	0.07
Palakolanu (APIIC)	0	0.00

Table 4.9 – Residential PSP Nos. and Areas

LAND PARCEL	INDUSTRIAL PSP NOS.	INDUSTRIAL PSP AREAS
Somayajulapalle (NICDC)	8	13.61
Komarolu Bit – I (NICDC)	3	9.78
Komarolu Bit - II (APIIC)	1	0.07
Total No. Of PSP/Amenities	**116**	
Total Area (Acres)		**179.47**

Source: Egis Analysis

Figure 4.13 – Public Semi-Public Amenities Plan



Source: Egis Analysis

4.13 - Utilities and Infrastructure

Utilities and infrastructure services include water supply, drainage, sewerage, solid waste management, and power generation. The utility plots have been placed in accordance with the site's landuse zoning. The sizes and numbers of plots assigned to each utility have been determined based on their respective requirements/demands. All utility locations have been properly connected to their surrounding land uses. As part of statutory requirements, common parking lots have been proposed across the land parcels for ease of accessibility for adjoining land uses.

Water supply: Water treatment plants of approximately 5 to 12 acres have been proposed within all the proposed land parcels for Orvakal Industrial Area. As the primary source of raw water has been proposed from Srisailam foreshore at HNSS lift station – zero at Muchumarri village, approximately 22km north of project area. The first WTP, shall be in Pudicherla land parcel, as the main water supply bends to enter the project area, while the second WTP shall be in the Guttapadu cluster, as it is centrally located to supply to all other land parcels to its south. Overhead tanks have been proposed within all zones as per water demand and further calculations.

Drainage: The entire project area shall be planned across catchment zones within the land parcels, with their respective storage zones and locally rainwater harvesting strategies shall be applied to achieve zero-discharge. Both these measures have been planned to ensure reduced losses from surface run-offs and run-off water contamination. The project area shall ensure that the regional drainage systems of the area remain uninterrupted and maintain capacities of existing water streams to avoid flooding or waterlogging within project area.

Sewerage: Due to the discontinuous nature of the land parcels, independent STP have been proposed at the individual land parcels, however a central CETP (including an STP of ~20 acres) has been proposed within Guttapadu land parcel. Most of the proposed STPs shall be modular capacities of 2.5 acres; land parcels with residential landuses would have to increase their STP capacities. CETP shall be planned in a with modular components to be developed across the phased development.

Power: A central step-down sub-station has been proposed at Guttapadu cluster over a 20-acre land, which shall supply the total demand for the entire project requirement. Each land parcel shall have a central ESR, and loop of electrical supply network planned across each land parcel. With proposed solar-power generation within project area, the project proposes to have solar powered street light zones and a central EV charging station.

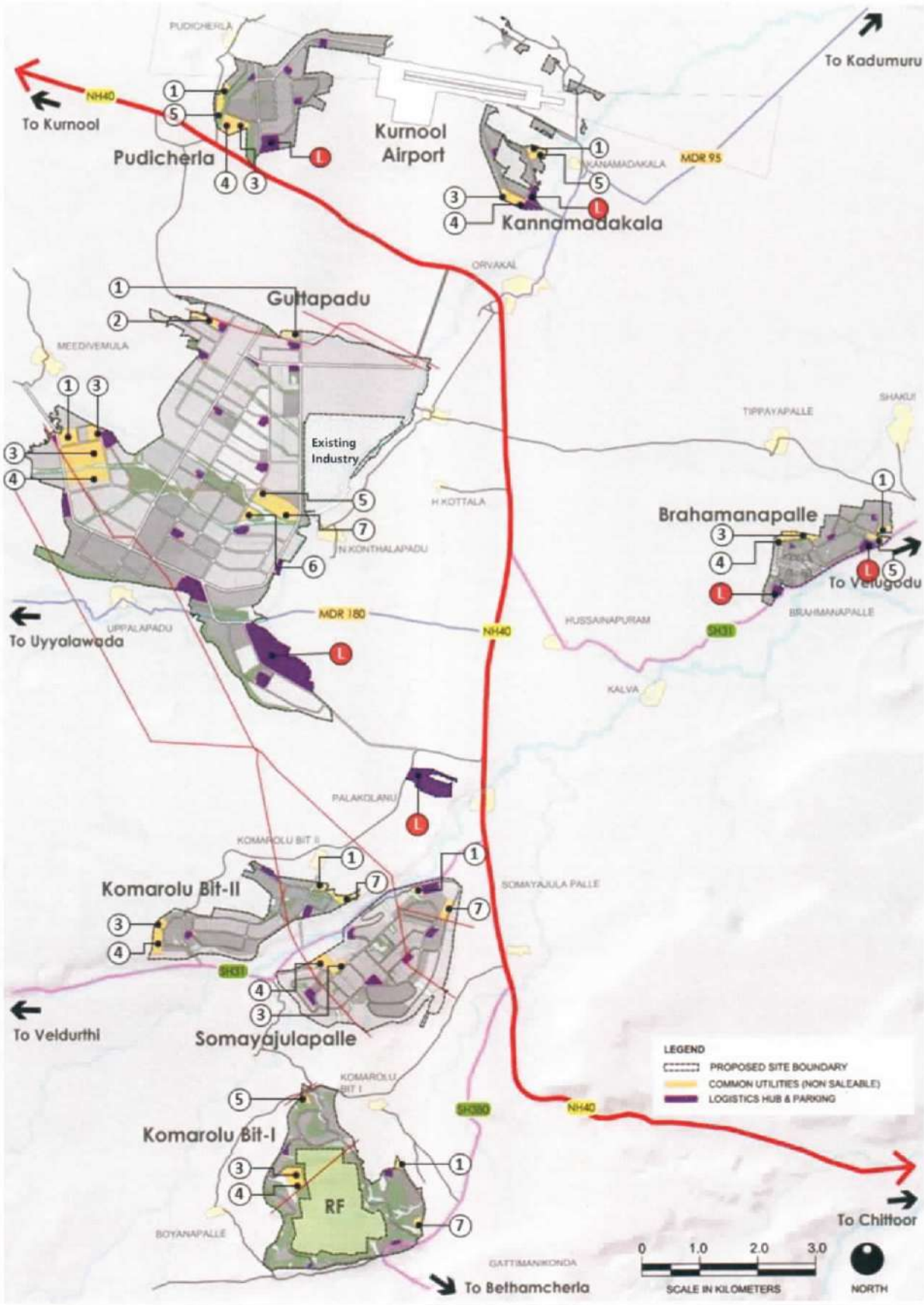
Solid waste: For solid waste management, Guttapadu cluster has designated a solid waste yard with adequate green buffer around.

The following table and the proposed utilities plan show the location and types of utilities proposed in Orvakal Industrial Area

Figure 4.14 – Proposed Utilities and Infrastructure

Source: Egis Analysis

Figure 4.15 – Utilities Plan



Source: Egis Analysis

4.16 - Plotting Strategy

The plotting plan has been prepared in consideration with the proposed zoning and landuse plan. The plotting strategy integrates the existing water features, greens, and HT lines into the design. It is a derivation of the landuse and road structure and has been chalked out considering the scope of plot amalgamation and subdivision at later stages. the plot size ranges used specifically for industrial plots are as under:

- Upto 1 Acre
- 1 Acre to 5 Acres
- 5 Acres to 10 Acres
- 10 to 20 Acres
- 20 to 30 Acres

Heavy industries with larger plot sizes have been proposed within the Guttapadu cluster, it being the largest land parcel followed by Somayajulapalle and Komarolu Bit II. Light industries plotting has been strategically located forming a transition zone between the residential and the heavy industries especially in Guttapadu. The rest of the light industries plots are distributed within the parcels of Pudicherla, Kannamadakala and Komarolu Bit I. Kannamadakala consist of a bigger plot dedicated to light industries. The business center has been plotted within the Pudicherla cluster is surrounded by light industries and residential plots forming a good synergy to increase economic opportunities for the residents as well as develop a robust technological and research base for the surrounding industries. Pudicherla has the advantage of direct connectivity with NH40.

Table 4.11 – Plot Details

PARCEL.	PLOT RANGE							TOTAL
	UPTO 1 ACRES	*1 – 3 ACRES*	*3 – 5 ACRES*	*5 – 10 ACRES*	*10 – 20 ACRES*	*20 – 3- ACRES*	*ABOVE 30 ACRES*	
Guttapadu	47	201	57	85	55	16	6	**467**
Pudicherla	4	73	9	12				**98**
Kannamadakala	2	30	4	1				**37**
Brahmanapalle	38	37	17	6	1			**99**
Somayajulapalle	26	109	42	18	3			**198**
Komarolu Bit – I			6	5	2			**13**
Komarolu Bit - II		121	14	5	1			**141**
Total	**117**	**571**	**149**	**132**	**62**	**16**	**6**	**1053**

4.17 - Landscape Strategy

4.17.1 - Landscape Element : Softscape Strategy

4.17.1.1 - Introduction

Planting plays an important role in ecosystem and is part of every community. Streets, parks, playgrounds, and backyards are lined with trees that create a peaceful, aesthetically pleasing environment. Trees increase quality of life by bringing natural elements and wildlife habitats into urban settings. They provide a safe space for outdoor activities with family and friends. Many neighbourhoods are also the home of very old trees that serve as historic landmarks and a great source of town pride. Using trees in urbanized areas to deflect the sunlight reduces the heat island effect caused by pavement and commercial buildings.

4.17.1.1.1 - Intent

- To add softness and aesthetics to otherwise paved areas and give diverse experiences to the users.
- To absorb air pollution. To reduce noise pollution
- To provide shade and reduce the heat generated from the paved surfaces
- To Increase local humidity that helps absorb dust.
- To help create a sense of enclosure and place making on streets for people to relax and enjoy.
- Flowering or deciduous trees create a changing seasonal urban experience.

4.17.1.1.2 - Guidelines

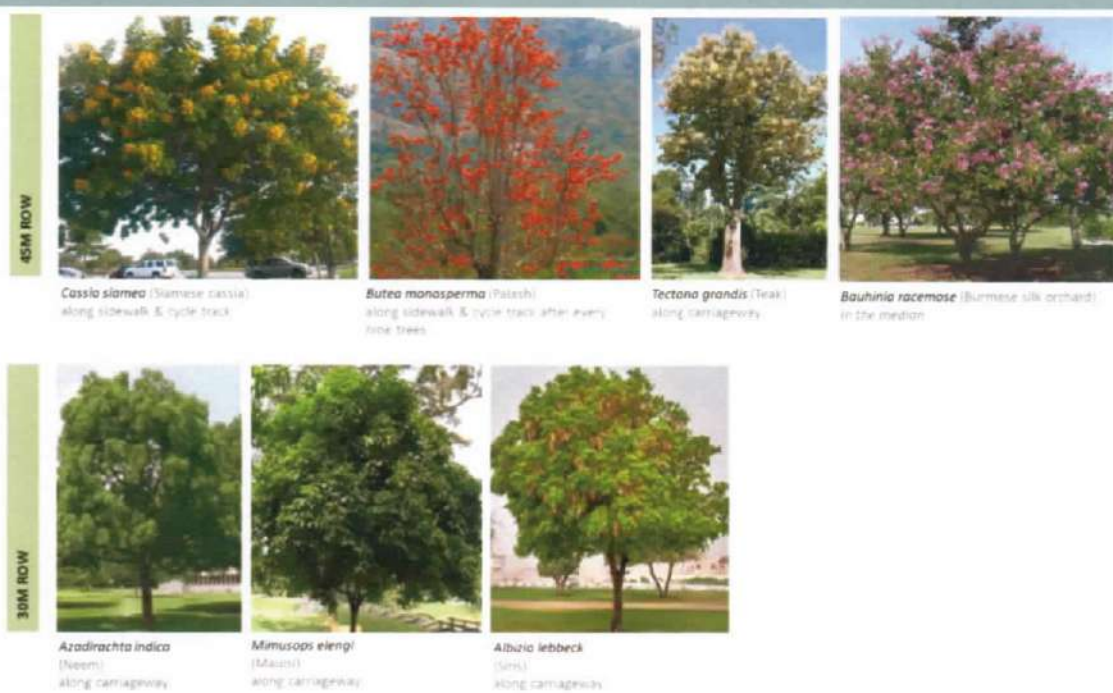
- Regional native deciduous & evergreen trees to be considered in the landscape.
- Planting strategy depends upon functionality, user group and typology of the space.
- The following criteria shall be considered in planting design :
  - 1. Plant Material
  - 2. Soil conditions
  - 3. Availiblity and quality of water
  - 4. Availiblity of sunlight
  - 5. Maintenance
  - 6. Functional Aspects of Design with Plants
  - 7. Planting for Shelter and Soil Conservation
- To ensure availiblity of sufficient width for avenue plantation, the requirement of land for tree plantation should be assessed and included in the land acquisition plans.

Landscape development should be in keeping with the character of the road and its environment. Before starting with any project, all existing trees must be identified, numbered, and marked on a Survey Plan and kept intact as much as possible.

- Trees should be carefully selected and planted as long term investments in the environment. Trees will provide a longer life span and require less maintenance than ornamental shrubs and ground covers.
- Trees must be placed such that they do not obstruct street lighting as well as visibility of traffic signals. Therefore, the Tree Planting Plan must be prepared in conjunction with the Street Lighting Plan.
- Trees must be pruned from the bottom such that all safety devices, signages and traffic signals are clearly visible to all road users.
- Tree guards should be provided for young trees.
- Tree openings of minimum 1.8m x 1.8m to be provided. Tree gratings to be finished at the same level as surrounding pavement – allow people to walk over them, while still allowing water, air and nutrients to access the roots.

- The roads are passing through the industrial area should have screen planting on either sides as they act as a buffer for noise and air pollution. In conditions where chemical industries are existing or are proposed it is advisable to have a thick green buffer which is resistant to noxious fumes.
- Plant annuals and perennials for raised planter beds or large free standing pots that complement the urban features along the pedestrian spines, plazas and building courtyards.
- Trees and shrubs should be planted at a minimum distance of 4 feet and 3 feet respectively from the building foundations to allow for maintenance and to reduce negative impacts from watering. The selected shrubs should not be invasive or have high watering demands. Use concrete or rolled-top steel edging to define and separate planting areas.
- A minimum area of 1.25m x 1.25m, around the trees should be left un-cemented. Widening of roads up to the trunk of trees is to be avoided as roots that come under the asphalt roads gradually die. Digging near the trees to make way for telephone, electricity, sewerage lines should be avoided to prevent root injury ; sufficient space should be left along the ground for the trees.
- Maintenance programs to include the following :
  - Preservation of existing vegetation,
  - Transplanting of existing vegetation wherever possible,
  - Planting of new vegetation,
  - Selective clearing and thinning,
  - Regeneration of natural plant species and material.
- Use a landscape ground fabric under rock cover areas, instead of impervious plastic sheets, to allow water and air to pass into the soil, but block unwanted weeds. Cover planting areas with organic mulch such as shredded wood. Use a 3 to 4-inch layer for trees, 3 inches for shrubs and 2 inches for perennials.

Figure 4.17 – Plantation Types



24M ROW

Delonix regia (Gulmohor)
along carriageway

18M ROW

Ficus benjamina (Weeping fig)
along carriageway

12M ROW

Cassia nodosa (Pink shower)
along carriageway

Source: Egis Analysis

Figure 4.18 – Planting Types

EVERGREEN TREES

Swietenia mahagoni
Mahogany

Mimusops elengi
Maulsri

Ficus religiosa
Peepal

Kigelia pinnata
Sausage

Grevelia robusta
Silver oak

Madhuca indica
Mahua

FLOWERING TREES

Bombax roxburgii
Red silk cotton tree

Spathodea campuniata
African tulip

Jacaranda mimisofolia
Neeli gulmohor

Lagrestromeia speciosa
Pride of India

FRUIT TREES

Mangifera indica
Mango

Phyllanthus emblica
Indian gooseberry/Amla

Manilkara zapota
Sapota/Chiku

EVERGREEN TREES

Azadirachta indica
Neem

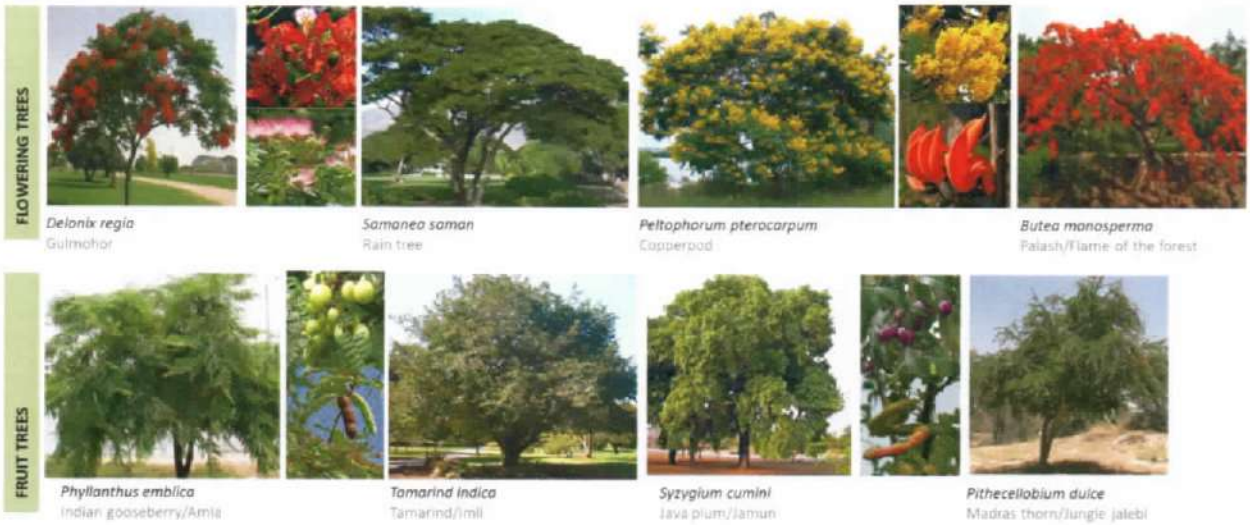
Ficus religiosa
Peepal

Cassurina equisetifolia
Whistling pine

Dalbergia sissoo
Shisham

Mimusops elengi
Maulsri

Polyalthia longifol
Ashoka

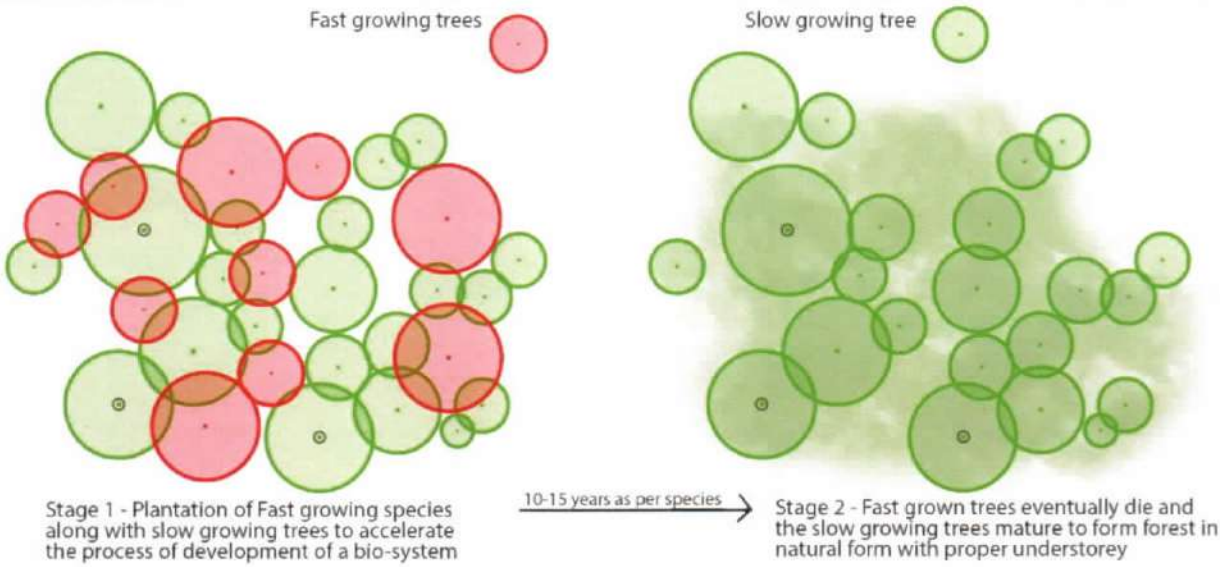


Source: Egis Analysis

4.17.1.1.3 - Planting Strategy in buffer areas

- Establishing 3 tiered plantation (trees, shrubs & groundcovers) to rejuvenate the ecological systems.
- Mix of Fast growing and Slow growing species – this will help to develop the green at an accelerated pace as most of the native species are slow growing ones. This strategy also reduces competition between the plants and promotes healthy uniform growth.

Figure 4.19 – Buffer Planting



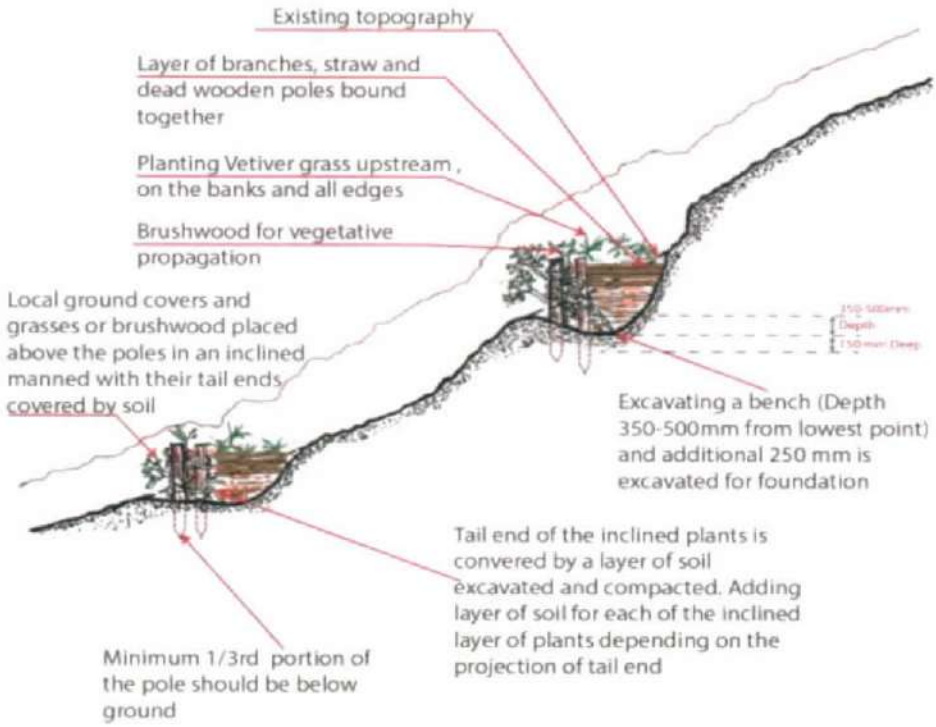
Source: Egis Analysis

4.17.1.1.4 - Planting Strategy along slope

Construction of small check dams will lead to following –

- Retaining of water and maintain the soil moisture and establish a layer of vegetation.
- Stabilizes slope and prevent the erosion by reducing the speed of water.

Figure 4.20 – Planting along the slope



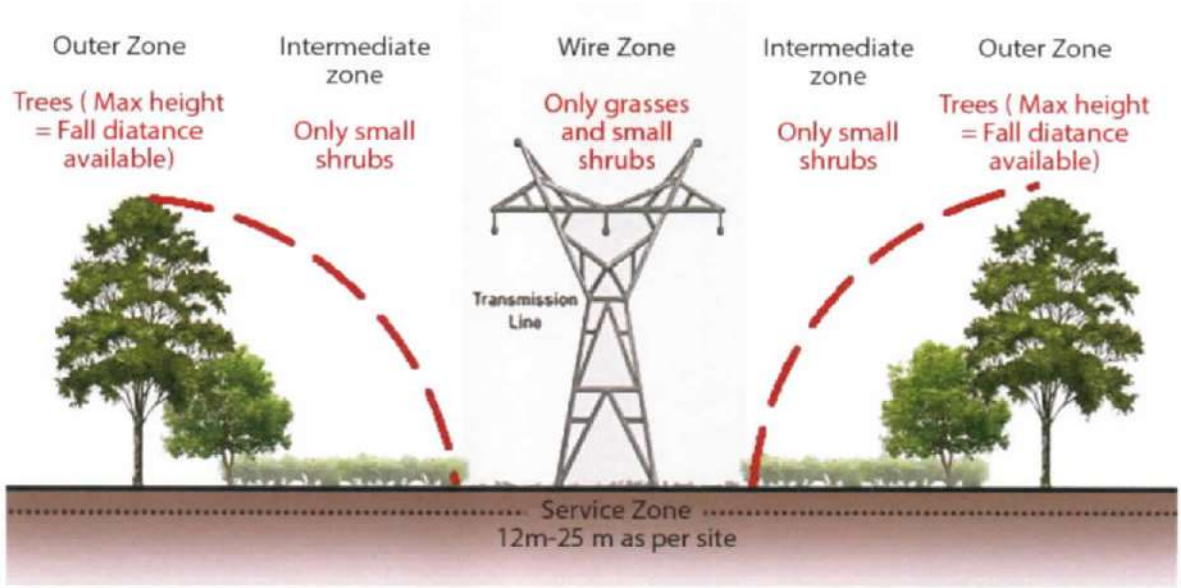
Source: Egis Analysis

4.17.1.1.5 - Plantation strategy along the HT line

The schematic section through the Electrical line corridors should be as given

- The Fall distance of the trees must be taken into account while plantation of the trees. Taller trees should be planted on either side of the service corridor to visually block the Electric poles.

Figure 4.21 – Planting along HT Line



Source: Egis Analysis

4.17.1.2 - Landscape Element : Drainage Strategy

4.17.1.2.1 - Introduction

Drainage systems are very important in the design of outer spaces. In simple words, a drainage system is a pipeline buried underground to conduct the water excess away from ones' plot. The three basic functions of any storm drainage system are to collect, conduct and dispose the storm run-off. The increased volume and velocity of runoff being caused by increased impervious urban development of the city can easily overwhelm the existing conventional drainage systems. Lack of effective erosion control may result in small channels or eroded areas, which may be costly to repair.

The urban drainage can be detailed into:

- Road surface drainage
- Sub soil drainage
- Infiltration into the ground for recharging of ground water table
- Disposal of storm water

Components of storm-water management system are:

- Swale
- Culvert
- Catch basin
- Drain inlet
- Area drain
- Trench drain
- Manhole
- Green roof
- Sediment basin
- Retention & detention basin
- Infiltration basin or rain garden

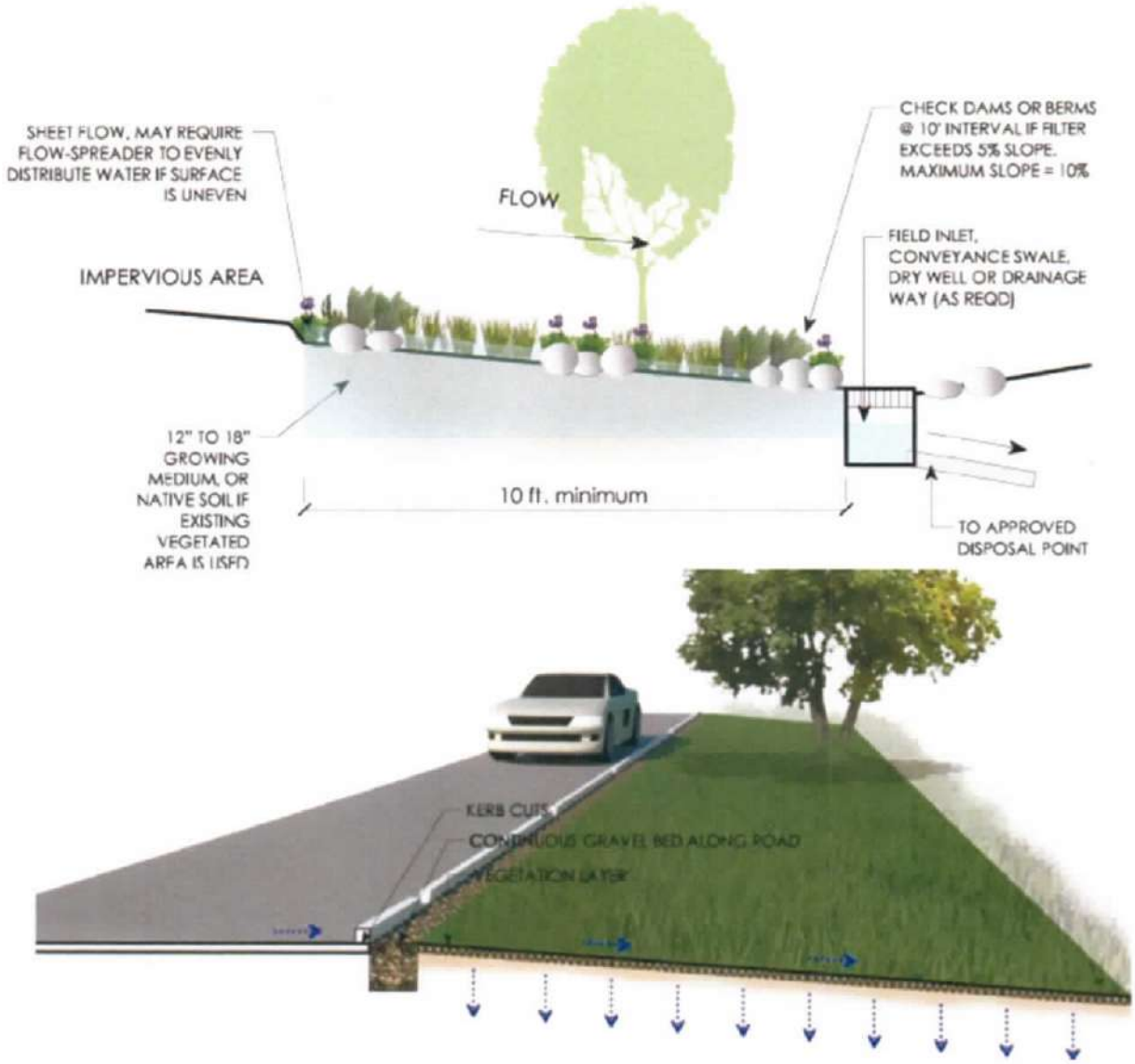
4.17.1.2.2 - Guidelines

- Urban drainage system should be designed such that, they capture the storm water runoff, from the road surface and right-of-way and infiltrate it into the ground closest to the source, where it is falling.
- Existing land and vegetation shall be left undisturbed. Corrective measures must be taken to reduce erosion within a drainage channel by using native grasses indigenous to the immediate area. Rip-rap shall consist of stone matching, or similar to, existing stone found on campus property. The use of culverts shall be avoided. Pedestrian bridges should be used, wherever possible.
- All disturbed slopes steeper than 4 :1 (25% slope) shall be seeded with native grasses, planted with xeric shrubs, and/or terraced with stone retaining walls.
- Urban drainage system shall be designed such that, they capture the storm water runoff, from the road surface and right-of-way and infiltrate it into the ground closest to the source, from where it falls.
- In case of lack of space, it should be conveyed along the right-of-way and discharged at the receiving body, in addition to infiltrating it into the ground at designated locations.
- The load on drainage would reduce, if infiltration into ground is effective. The infiltration shall happen even while conveying and disposing effectively, and would also recharge the depleting ground water table which is reducing at an alarming rate due to intensive urbanization, paving of roads and private properties.
- Bio-swales are recommended along the road-side planting strips, within MUZs, within wide central medians and spaces created by grade separators. Minimum width of swales should be 1m and ideally run continuously along the stretch of the road.
- Permeable pavers should be used for parking belts and sidewalks and any other non-vehicular roadways in parts or in totality.

4.17.1.2.3 - Types of natural drainage systems

- Vegetated filter
  - Vegetated filter strips, or vegetated filters, are gently sloping areas used to filter, slow, and infiltrate storm water flows.
  - Storm water enters the filter as sheet flow from an impervious surface. Flow control is achieved using the relatively large surface area and for slopes greater than 5%, a generous proportion of check dams or berms.
  - Pollutants are removed through filtration and sedimentation.

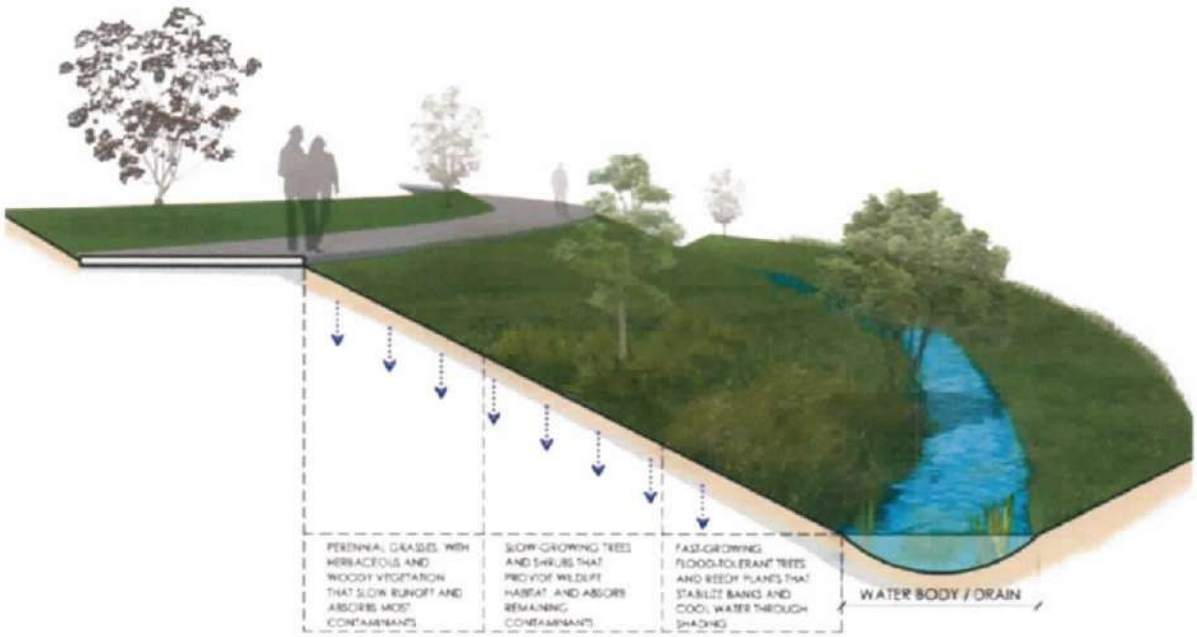
Figure 4.22 – Vegetated Filter



Source: https://www.nrcs.usda.gov/

- Riparian Buffer
  - A riparian buffer is a vegetated strip along the banks of flowing water body.
  - Riparian buffers are simple, inexpensive ways to protect and improve water quality through local plant materials.
  - Buffer strips structurally stabilize banks and shorelines to prevent erosion. Trees and shrubs
  - Provide shade to maintain consistent water temperature necessary for the survival of some aquatic life.
  - Width of the buffer is based on surrounding context, soil type, size and slope of catchment area, and vegetative cover.

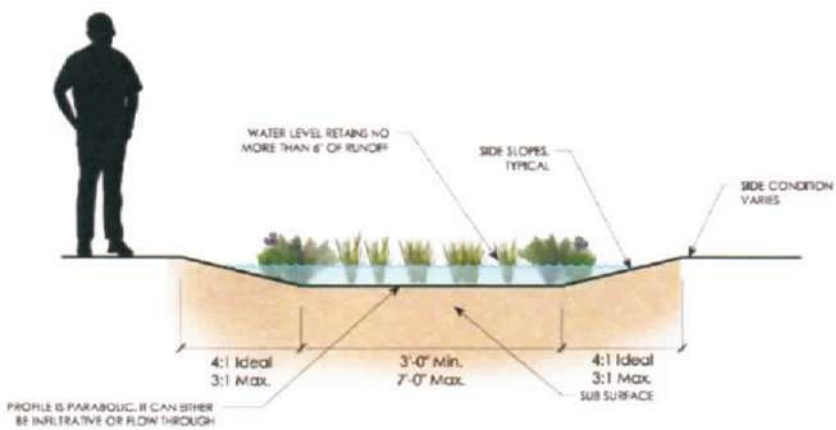
Figure 4.23 – Riparian Buffer



Source: http://www.remarkableriparian.org/

- Bio Swale
  - Bio swales are linear channels designed to concentrate and convey storm water runoff while removing debris and pollution. Bio swales can also be beneficial in recharging groundwater. They are typically vegetated, mulched, or xeriscaped. They consist of a swale drainage course with gentle sloped sides.
  - The soil and vegetation in bio swales can root out pollutants and contaminants that would otherwise end up in storm water systems and water bodies. By reducing the amount of water that ends up in primary storm water system and cleaning what does go in, one can approach resilience from two directions.
  - Areas of application - Roads, Parks, Play fields etc.

Figure 4.24 – Bio Swales

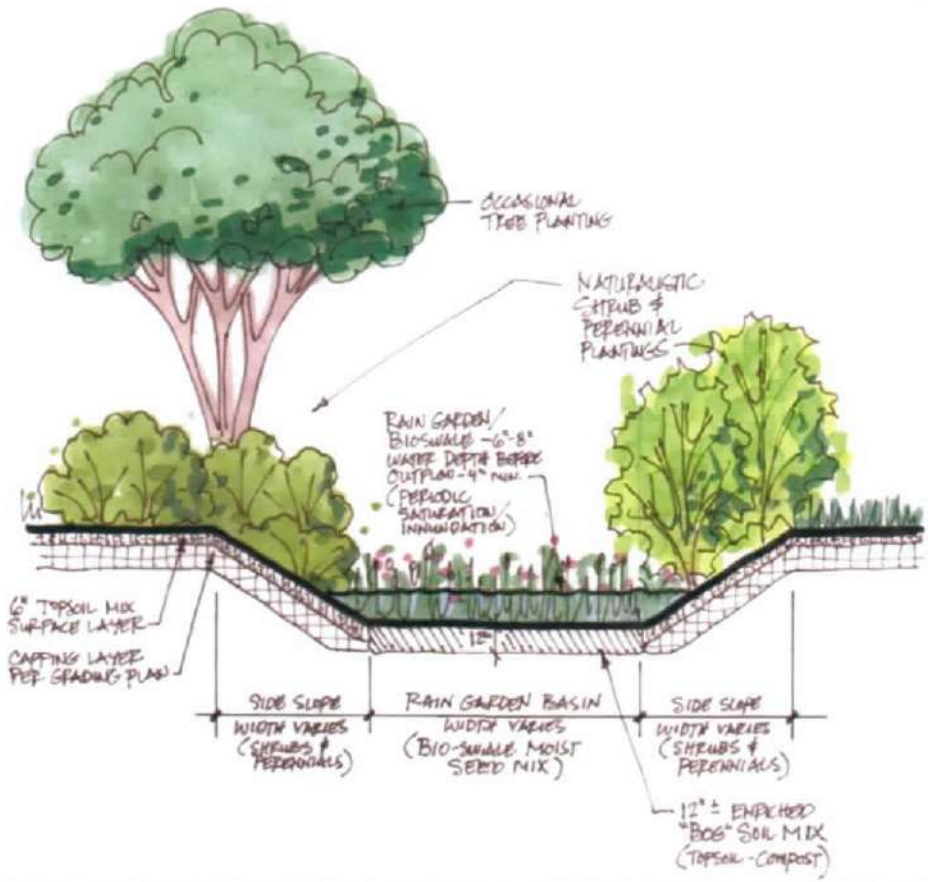


Source: https://theconstructor.org/

- Rain Garden

Rain gardens are landscaped depressions that receive storm water runoff and allow the runoff to slowly infiltrate to the groundwater table as well as intercept storm water runoff that could be the potential flooding problem. The rain garden allows nature to play a role by removing some of the pollutants that would have otherwise affected downstream water quality. During infiltration, biological and physical processes remove pathogens as plants use excess nutrients for growth. Dissolved metals and nutrients bind or absorb to soil particles and are removed temporarily out of the system. Rain gardens also create important habitat for bees, butterflies, and birds.

Figure 4.25 – Rain Garden



Source: https://wendelcompanies.com/

4.17.1.3 - Landscape strategy for 1st order stream

In order to preserve the existing natural drainage pattern in the site, it is very important to conserve the 1st order streams that generate within and around the site. There are numerous 1st order streams and those should be conserved morphologically for the river systems to sustain.

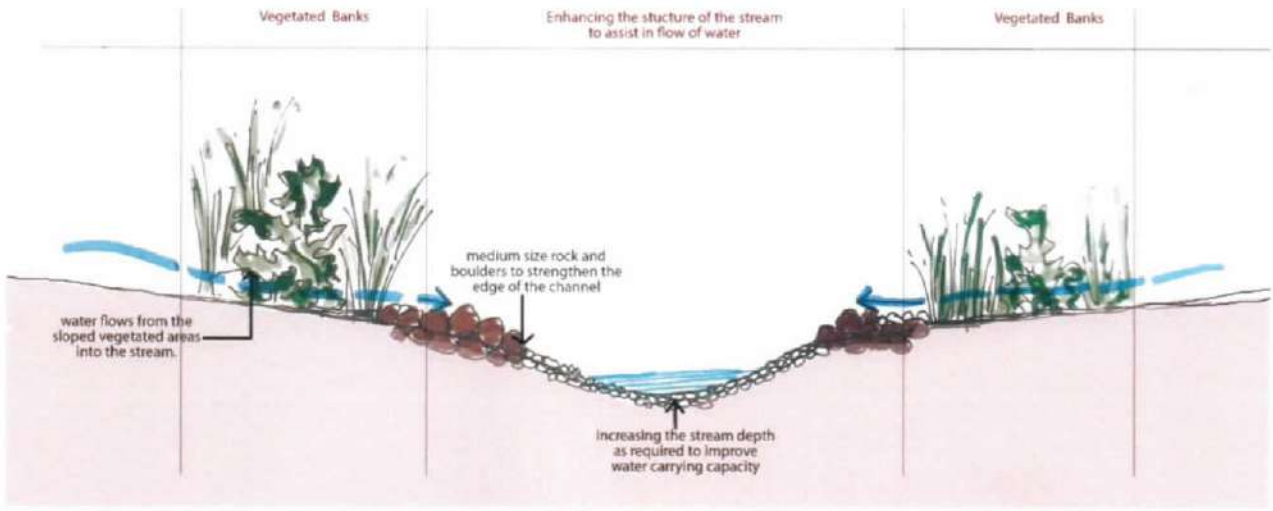
All the first order stream to have a buffer zone at least 7.5 m wide on both sides. The channels can be morphologically altered to achieve

- Better flow direction of water
- Prevent sedimentation in the channel.

This can be achieved by following by

- Vegetated Banks. These are Vegetation and surface protection along the edges can cause resistance to flow, slow down and deflect it away from banks, altering the forces applied to the bank surface and protecting edges against erosion. A combination of herbaceous and woody plant types is best for curtailing erosion along the stream edge - herbaceous plants have fibrous root systems that can protect banks from surface erosion. Woody species with deeper roots are better at increasing soil cohesion. Vegetation also helps in intercepting fertilizers, pesticides, heavy metals, and other pollutants in runoff. It also balances temperature for invertebrates along the edge and provides habitat to a number of species of butterflies, birds, frogs, dragonflies, etc.

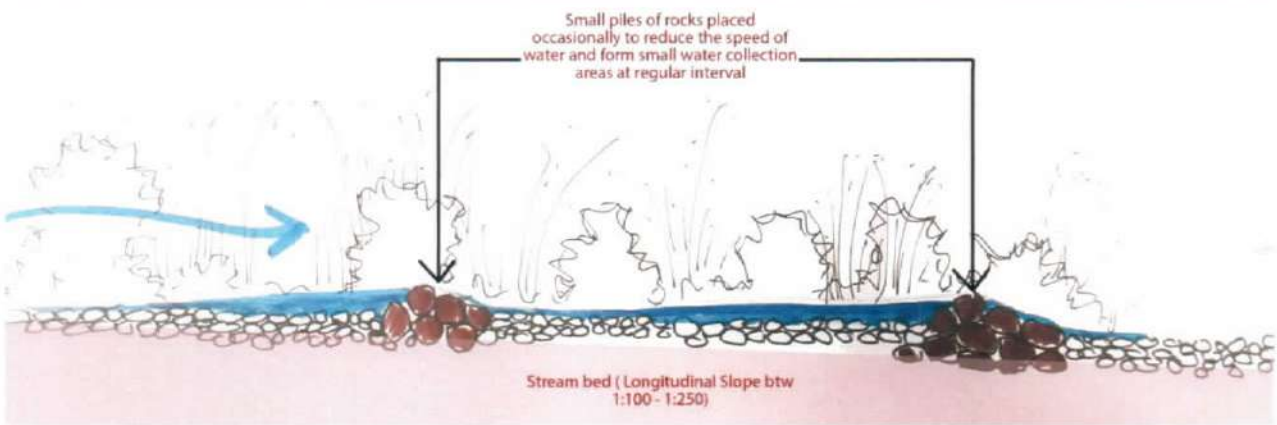
Figure 4.26 – Vegetated Banks



Source: Egis Analysis

- Rectifying Longitudinal slope -The stream bed can be altered at regular interval to reduce the speed of water and hold it long enough to increase the moisture content of soil in nearby areas. This will in turn enhance the vegetation in the bank. These points can act as mini biodiversity hotspots.

Figure 4.27 – Rectifying Slopes



Source: Egis Analysis

4.17.1.4 - Landscape Element : Retaining Wall Strategy

4.17.1.4.1 - Introduction

A retaining wall is a structure, either freestanding or laterally braced that bears against an earth or other fill surface and resists lateral or other forces from the material in contact with the side of the wall. Retaining walls are commonly used to level, retain, or terrace a sloping area and to minimize the grading necessary to achieve developable building pads. Retaining walls are also used in combination with backfill, to increase the usable/developable areas of a site and as an alternative to manufactured slopes.

4.17.1.4.2 - Objective of Retaining Wall guidelines

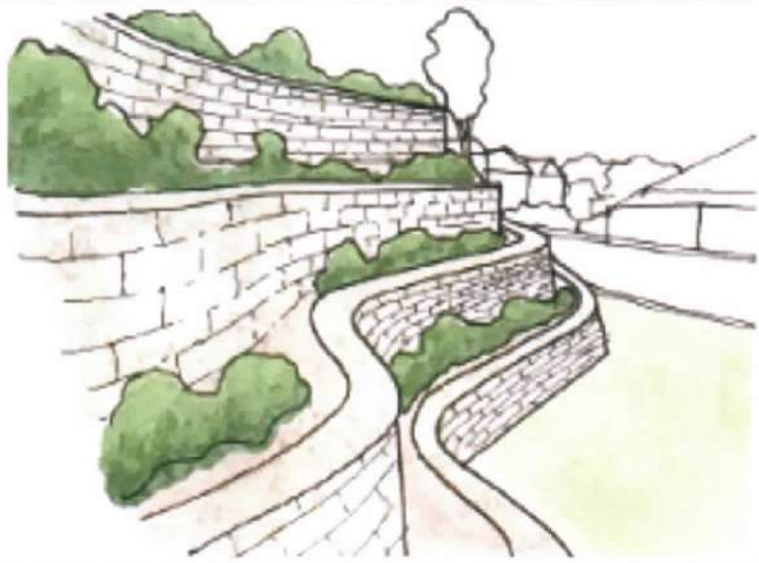
Retaining walls are designed to minimize visual impact and are compatible with surrounding environment, exhibiting proper scale, mass, form, and character. They should provide visual interest and incorporate quality design features.

4.17.1.4.3 - Types of Retaining Walls and Guidelines :

There are three basic types:

- **Gravity walls-** This type of retaining wall used the weight of the wall slab or blocks combined with the friction of the blocks, gravel and soil to give the structure its strength. In addition to dry laid stone walls, other kinds of gravity walls use open stacked cellular elements that are filled with granular materials which holds them in place while allowing for drainage through the wall. They are also considered "flexible" walls because some normal shifting and movement of the structure will not affect its integrity.
- **Cantilevered Walls-** Also referred to as rigid walls intended to remain absolutely stationary. They are built on solid foundations with the base tied to the vertical portion of the wall. The base is then filled to counteract forward pressure.
- **Mechanically stabilized earth walls-** these are typically constructed in fill situations using a construction technique that alternates layers of compacted soil and horizontal soil reinforcing elements or "mats". Structures built on soil retained wall must be setback considerably from the horizontal reinforcing elements. The face of the wall is composed of stacked precast concrete units that tolerate differential movement.

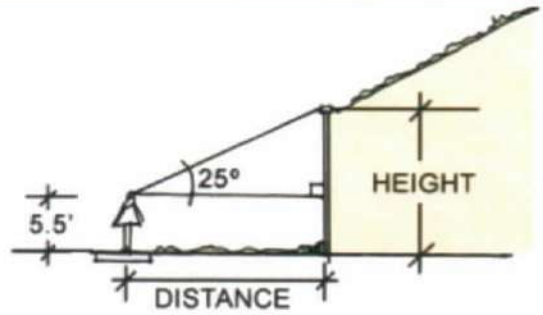
Figure 4.28 – Mechanically Stabilised Earth Wall



Source: Egis Analysis

Table 4.12– Recommendations for Retaining Wall

Height of Wall (Ft.)	Distance (Ft.)
10	10
15	20
20	30
25	40
30	50
35	65



Source: Egis Analysis

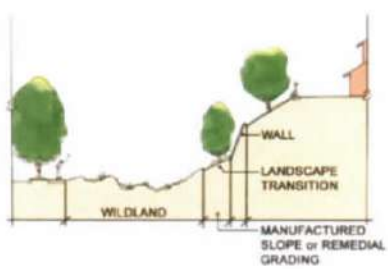
They should exhibit a height to setback relationship that is appropriate to the context and setting and is not overwhelming for the viewer with consistent ratios.

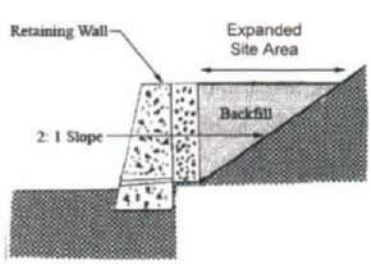
- Landscape setback in front of a retaining wall should be increased in proportion to the height of the wall.
- In commercial and industrial areas, place necessary walls at the rear of sites as opposed to on the street side. At corner locations, curve or angle the wall along the street frontages to avoid "sharp" corners.
- In vehicular-oriented settings where the wall is viewed from a distance or when traveling at greater speeds, use techniques that help the wall blend in with the environment, such as varied height, terracing and landscaping.

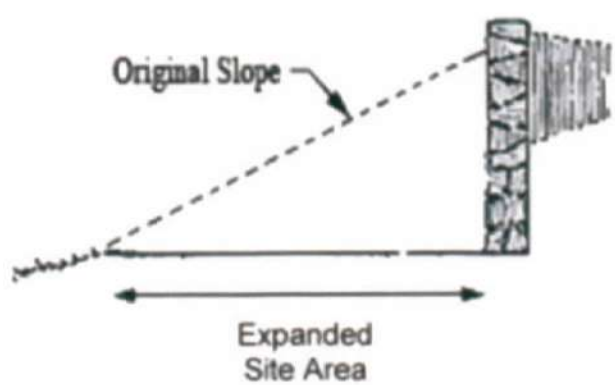
In areas adjacent to natural open space, incorporate native landscaping and undulating, irregular configurations in an effort to blend the wall into the surroundings.

- Provide adequate space at the top and base of retaining walls to allow for drainage improvements. Provide a landscape area at the top of the wall as a transition or buffer to the building pad. Where applicable and appropriate, provide a safety railing at the top of the wall. Open fencing is encouraged where appropriate, in lieu of a wall or solid fence.
- Walls with exposed faces visible from sidewalks, streets, parking lots and other public spaces should be designed with aesthetically pleasing surfaces.
- Diligently placed retaining walls can be used to increase the plot area by cutting or filling.

Figure 4.29 – Technical details of retaining wall







Source: Egis Analysis

4.18 - Proposed Land Parcels

These sections shall explain the proposed layout for each land parcel, along with its planned transport connectivity and open space networks.

4.18.1 - Guttapadu

As the largest consolidated land parcel within OIA, this cluster has been planned as an integrated area with APIIC area on the north and NICDC areas in the south. The broad landuse have been planned to hold comprehensive mix of industrial sectors and maintain statutory compliance for proposed landuse.

Industrial landuse have been planned for multiple industrial sectors. In the northern half of the land (APIIC area) a mix of red and orange industries have been proposed with industrial sector categories like pharmaceutical, pharmaceutical formulation, Secondary steel& speciality steel, and some Engineering & Electrical component industrial plots etc. While the southern half of this cluster (NICDC area) includes a multiple mix with orange, green and few white industries, including Electrical & Electronics, Textile, Gems and jewellery, Aerospace defence and hardware industrial plots etc.

This land parcel has an existing industry- Jai Raj Ispat categorised under Hazardous/polluting Industry in an extent of 413,19 Acres. The water supply, WTP and CETP facilities are already being developed by them and hence their demands are not considered in the Master Plan.

4.18.1.1 - Residential landuse

Almost 46 acres of residential landuse has been planned to accommodate a population of about 9262 and includes affordable housing and some MIG housing units, along with requisite residential amenities within the residential area.

4.18.1.2 - Amenity landuse

4.18.1.2.1 - Commercial landuse (Amenities –II) and Public-Semi-Public landuse (Amenities –I)

Amenities have been spread across this cluster in accordance with the broad landuses. While a Secondary school, few crèches, an anganwadi, a community rooms, and a convenience shopping area have been planned near the residential landuse in southern precinct of Guttapadu cluster. In the remain areas, multiple PSPs including training centres, telecommunication centres and multiple convenience shopping areas with ATM and PO facilities, have been planned within walkable distances of most industrial plots.

4.18.1.3 - Logistics land use– designated parking and logistics area

Multiple parking lots of almost 3 to 5acres have been located within walkable distance of all industrial plots and a designated logistic hub has been planned in the southern area of this Guttapadu cluster.

4.18.1.4 - Open spaces landuse

Guttapadu land parcel has multiple seasonal streams, and these have been retained with 9m vegetated buffers as riparian corridors. These area with abutting additional open space creates green open space network throughout the cluster allowing shaded pedestrian connectivity. Large designated open spaces have also been provided with this cluster near wider water stream belts.

4.18.1.5 - Infrastructure utility landuse

This land parcels holds the largest number of industrial plots and supporting facilities and hence holds the largest utility facilities, with a summer storage tank of 120 acres and CETP and STP combined plot another 100 acres, both are located centrally on either ends of the land parcel. Other utility areas include a solid waste segregation yard in the northern area of the cluster.

Figure 4.30 – Guttapadu Cluster Aerial View

Top View

Birds Eye View

Source: Egis Analysis

Figure 4.31 – Guttapadu cluster aerial view

Heavy Industrial Areas (Red and Orange Category)

Light Industries seperated by the green buffer (stream) from the heavy industries

Source: Egis Analysis

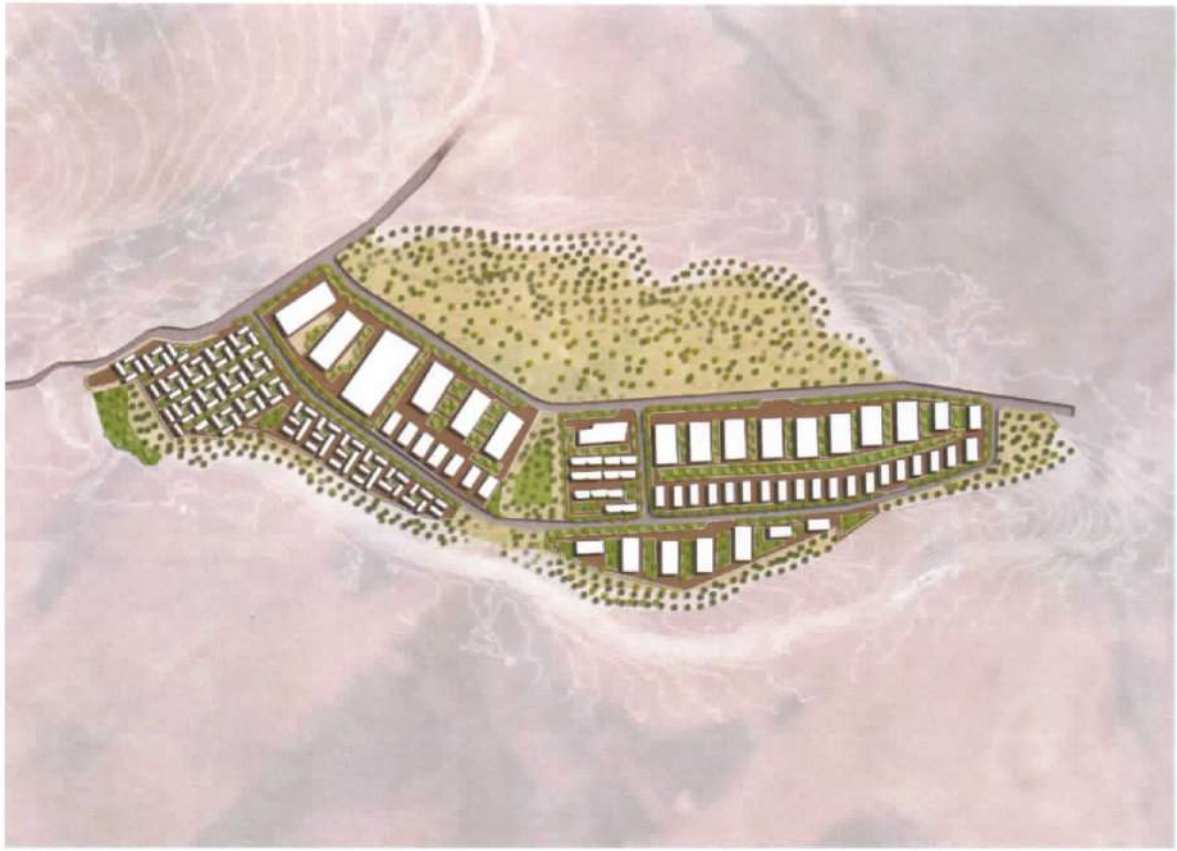
Figure 4.32 – Guttapadu cluster aerial view

Residential area at the southern tip

View of the retained stream within the heavy industries

Source: Egis Analysis

Figure 4.33 – Focus Areas in Guttapadu Cluster



View of the residential area adjacent to the light industries at the southern tip of Guttapadu

Light Industries surrounded by water stream

Source: Egis Analysis

4.18.2 - Pudicherla

One of the northern most land parcels within OIA, this cluster lies in adjacent to Uyyalawada Narasimha Reddy Airport, hence, to attract hospitality and allow airport supporting facilities, a mix of landuses have been proposed in this cluster. The broad landuses includes premium residential, affordable housing, some industrial landuses, with a designated area identifies for Business centre and auxiliary service landuses:

4.18.2.1 - Industrial landuse

Only white and some green industrial landuse have been planned in this land parcel, considering it neighbours the airport and has been planned considering constraints in relation to height and noise levels in proximity to an airport. Hence, industrial plots allocated for industrial sectors like non-polluting Electrical & Electronics, textile and food & beverages have been planned in this land parcel.

4.18.2.2 - Residential landuse

Almost 27 acres of residential landuse has been planned to accommodate a population of about 5724 and includes plots for HIG, MIG and some affordable housing units, along with requisite residential amenities within the residential areas. These residential plots area face a linear strip of designated open space and well connected to the main arterial road network.

4.18.2.3 - Amenity landuse

4.18.2.3.1 - Commercial landuse (Amenities –II) and Public-Semi-Public landuse (Amenities –I)

Multiple PSPs including training, communication & telecommunication centres and multiple convenience shopping areas with ATM and PO facilities, have been planned within walkable distances of most industrial plots and few school facilities, an anganwadi and a convenience shopping centre have been proposed near residential areas.

4.18.2.4 - Logistics land use– designated parking and logistics area

Logistic area in this land parcel includes a few designated parking lots near industrial landuses.

4.18.2.5 - Open spaces landuse

A natural green strip has been planned in this pocket along with a designated open space corridor planned to connect residential area with industrial areas passing through the commercial landuses. This creates a good open space network for the entire land parcel and allows good pedestrian connectivity away from traffic. 3 large designated open spaces have been proposed in the centre of this land parcel as a relief zone and congregation spaces adjacent to commercial landuses.

4.18.2.6 - Infrastructure utility landuse

Utility land parcels have been planned along the outer peripheries of this land parcel, however, abut the main arterial road network. A consolidated area has been earmarked for CETP-STP and Summer storage tank. Other utilities for power, water supply and solid waste management have also been proposed within this land parcel.

Figure 4.34 – Pudicherla Parcel Aerial View

View of the Business Centre along with the adjacent landuses

Business Centre along with the approach road

Source: Egis Analysis

Figure 4.35 – Pudicherla Parcel Aerial View

Aerial view of the business centre from the north

Aerial view of the business centre from the east

Source: Egis Analysis

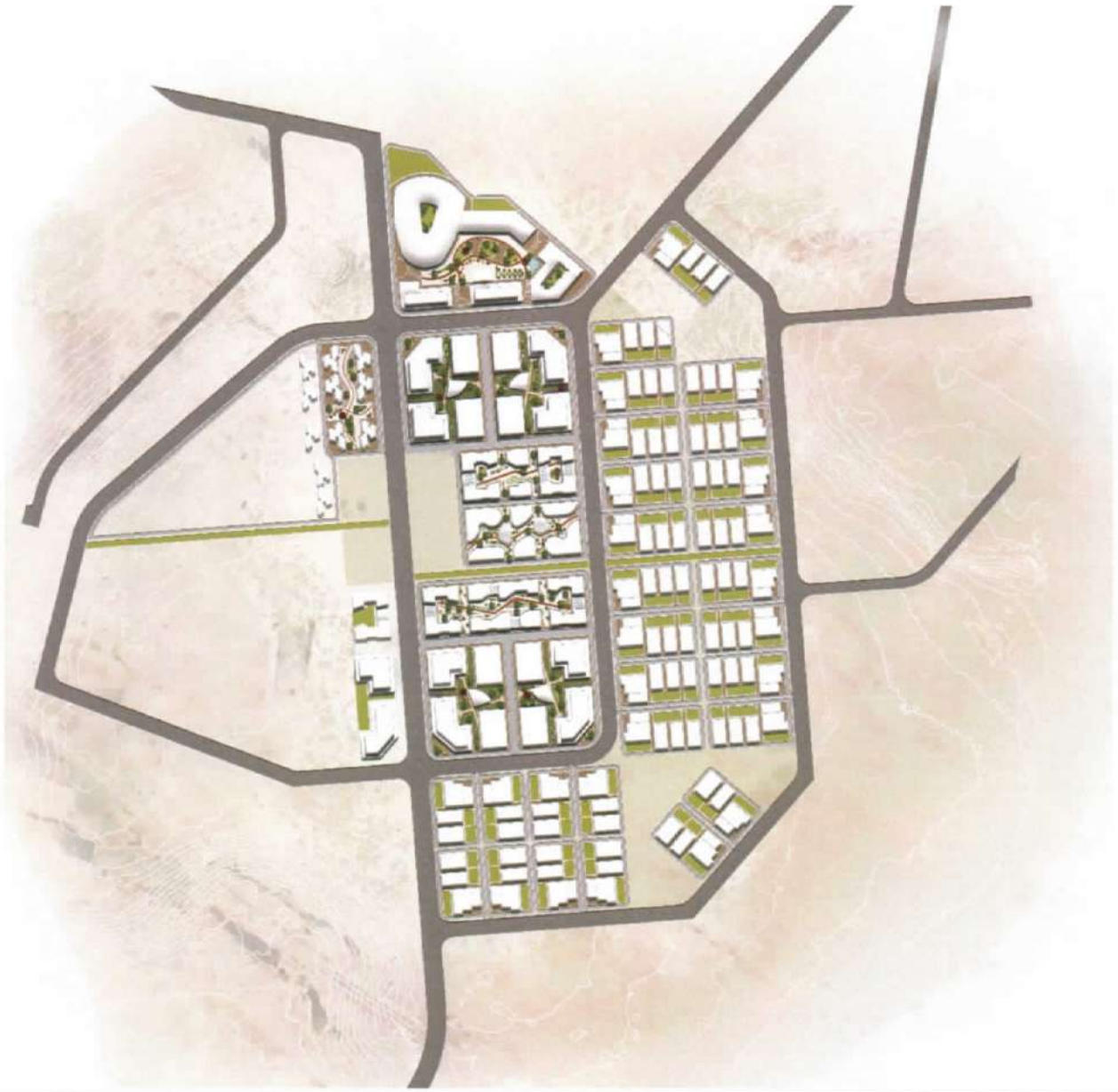
Figure 4.36 – Pudicherla views

Business Centre Perspective view 1

Business Centre Perspective view 2

Source: Egis Analysis

Figure 4.37 – Focus Areas in Pudicherla



Top View of the Business Centre and light industries

Source: Egis Analysis

4.18.3 - Kannamadakala

This is a cluster of dispersed land parcels within OIA, and is also neighbouring Uyyalawada Narasimha Reddy Airport, and planned to landuses for auxiliary and supporting facilities for the airport. The largest land parcel of this cluster houses only industrial landuses while all other dispersed land parcels have been planned for residential and supporting landuses:

4.18.3.1 - Industrial landuse

Planned near the airport and with its requisite constraints limiting height, air quality pollution and noise levels, only white and some green industrial landuse have been proposed in Kannamadakala largest land parcel. Hence, some warehousing facilities for food & beverages based industrial plots have been planned in this land parcel.

4.18.3.2 - Residential landuse

The dispersed land parcels shall house low-rise MIG residential plots and some affordable housing units in separate land parcels.

4.18.3.3 - Amenity landuse

4.18.3.3.1 - Commercial landuse (Amenities –II) and Public-Semi-Public landuse (Amenities –I)

Few PSP plots have been kept in east and west sides of the largest land area within Kannamadakala, which including training, communication & telecommunication centres and convenience shopping areas with ATM and PO facilities and these have been planned within walkable distances of most industrial plots. A Senior secondary school has been proposed in central smaller land parcel near residential plots, while an anganwadi and a convenience shopping centre have been proposed near designated cluster green in a residential land pocket.

4.18.3.4 - Logistics land use– designated parking and logistics area

Designated parking lots and a consolidated logistic area near site entry have been proposed in the largest land parcels within Kannamadakala with industrial plots, while all parking facilities for residential shall be planned within residential premises as no on-street parking shall be encouraged.

4.18.3.5 - Open spaces landuse

Small open space pockets have been planned near small seasonal water stream areas in the land parcel with industrial plots.

4.18.3.6 - Infrastructure utility landuse

A small CETP-STP has been proposed along with a small summer storage tank with largest land area within Kannamadakala. Other utility plots for power, water supply and solid waste management have also been proposed within this land parcel. For other dispersed land parcels shall tap from this utility through external connectivity corridors.

Figure 4.38 – Kannamadakala focus area

Green Industries along the approach road top view

Green Industries along the approach road aerial view

Source: Egis Analysis

Figure 4.39 – Kannamadakala Parcel Aerial View

Industries seperated by the green corridor

View of the industries and the site buffers from the north

Source: Egis Analysis

Figure 4.40 – Kannamadakala Parcel Aerial View

View of the Industries on the northwest

Source: Egis Analysis

Figure 4.41 – Focus Area in Brahmanapalle

Top view of the proposed industrial areas within Brahmanapalle

Aerial view of the proposed areas within the parcel

Source: Egis Analysis

Figure 4.42 –Brahmanapalle Aerial View

Red and Orange industries separated by the existing stream (View 1)

Red and Orange industries separated by the existing stream (View 2)

Source: Egis Analysis

Figure 4.43 –Brahmanapalle Aerial View

White industries separated from the heavy industries by the green buffer

Aerial view of the site from the east direction

Source: Egis Analysis

4.18.5 - Palakolanu

Smallest land parcel within OIA, lies close to Guttapadu cluster, Komarolu Bit-II and Somayajulapalle land parcels. There is a DRDO land area near this parcel as well and hence this parcel houses only logistic facilities to support OIA landuses.

4.18.5.1 - Industrial landuse

There are no industrial landuses proposed in this land parcel.

4.18.5.2 - Residential landuse

There are no residential landuses proposed in this land parcel.

4.18.5.3 - Amenity landuse

4.18.5.3.1 - Commercial landuse (Amenities –II) and Public-Semi-Public landuse (Amenities –I)

There are no PSP landuses proposed in this land parcel.

4.18.5.4 - Logistics land use– designated parking and logistics area

This land parcels lies very close to NH-40 and so the entire land parcel shall be developed as a central logistic hub of almost 58 acres, in addition to logistic area in Guttapadu cluster.

4.18.5.5 - Open spaces landuse

There is no designated green proposed in this land parcel.

4.18.5.6 - Infrastructure utility landuse

A small CETP-STP and additional utility plots for power, water supply and solid waste management have proposed within this land parcel near the main entry points into this land parcel.

Figure 4.44 – Palakolanu views

Proposed Logistics Area

Source: Egis Analysis

4.18.6 - Somayajulapalle

This land parcel lies close to NH-40 and site along west-bound SH-31 within OIA and includes only industrial landuses along with supporting facilities and landuses.

4.18.6.1 - Industrial landuse

This land parcel houses red and orange industries for Chemical & Chemical products, Food & Beverages and Non-metallic mineral based industries.

4.18.6.2 - Residential landuse

There are no residential landuses proposed in this land parcel.

4.18.6.3 - Amenity landuse

4.18.6.3.1 - Commercial landuse (Amenities –II) and Public-Semi-Public landuse (Amenities –I)

Dispersed PSP pockets have been planned across this land parcel which will have training, communication & telecommunication centres and convenience shopping areas with ATM and PO facilities. There is an Industrial training centre also proposed in this land parcel.

4.18.6.4 - Logistics land use– designated parking and logistics area

A designated logistic plot near site entry has been proposed, with multiple small parking lots spread across Somayajulapalle.

4.18.6.5 - Open spaces landuse

Due to topographical constraints this land parcel has central plateau and surrounded by steep slope along the periphery. Hence, wide strip of open space has been planned along the periphery so that these peripheral edges act as mitigating buffer for any potential pollution. Smaller designated cluster greens have been proposed centrally to all industrial plots.

4.18.6.6 - Infrastructure utility landuse

A medium size CETP-STP has been proposed for Somayajulapalle while a summer storage tank has been proposed closer to west-bound SH-31 for this land parcel. Other utility plots for power, water supply and solid waste management have also been proposed within this land parcel.

Figure 4.45 – Focus Area in Somayajulapalle

Top and Aerial views of the focus area (Orange Industries towards extreme northwest)

Source: Egis Analysis

Figure 4.46 – Focus Area in Somayajulapalle

Open Spaces adjacent to the heavy industries

Source: Egis Analysis

4.18.7 - Komarolu Bit-II

This parcel lies closest to DRDO land area and hence has been proposed with industrial landuses to support auxiliary facilities and landuses for this neighbouring development.

4.18.7.1 - Industrial landuse

This land parcel houses red, orange and some green industries for Food & Beverages, Textile & Apparel based industrial sectors and some non-metallic mineral industrial plots.

4.18.7.2 - Residential landuse

There are no residential landuses proposed in this land parcel

4.18.7.3 - Amenity landuse

4.18.7.3.1 - Commercial landuse (Amenities –II) and Public-Semi-Public landuse (Amenities –I)

PSP pockets have been planned in near designated open spaces and central to all industrial plots, which will have training, communication & telecommunication centres and convenience shopping areas with ATM and PO facilities.

4.18.7.4 - Logistics land use– designated parking and logistics area

A small logistic plot has been proposed near land parcel entry into Komarolu Bit-II. Small parking lots have been planned across the land parcel within walkable distances of all industrial plots.

4.18.7.4.1 - Open spaces landuse

Designated open space pockets have been planned along seasonal water stream crossing the land parcel and create good pedestrian connectivity with shaded pathways across industrial plots.

4.18.7.4.2 - Infrastructure utility landuse

A summer storage tank has been proposed in the east corner of this land parcel. Further south, arterial road also has a CETP-STP has been proposed. Dispersed utility plots for power, water supply and solid waste management have also been proposed throughout this land parcel.

Figure 4.47 – Focus Area in Komarolu Bit II

Top and Aerial views of the focus area (Red industries on the north east direction of the parcel)

Source: Egis Analysis

Figure 4.48 – Focus Area in Komarolu Bit II

View of the recreational areas adjacent to the industrial plots

Source: Egis Analysis

Figure 4.49 –Komarolu Bit II Aerial views

View of the Industrial areas along with the approach road

View of the heavy industrial area with proposed recreational spaces in between

Source: Egis Analysis

4.18.8 - Komarolu Bit-I

The southernmost land parcels within OIA, this cluster neighbours a notified reserved forest block with sparse plantation. Hence, this cluster proposes to include mostly residential land uses with very few white industrial plots in the south-east corner.

4.18.8.1 - Industrial landuse

Only white industrial landuse have been proposed in this land parcel, for non-polluting rubber & Plastic product based, Paper & paper products and some printing and publishing-based industries.

4.18.8.2 - Residential landuse

Almost 177 acres of residential landuse has been planned for14,000 people and includes plots for HIG, MIG and some affordable housing units and plotted development areas, along with requisite residential amenities within the residential areas. These residential plots area dispersed across the undulating terrain of this land parcel and get benefit of being close to designated open space and well connected to the main arterial road network. A business centre has also been proposed along West-bound SH-31 as well.

4.18.8.3 - Amenity landuse

4.18.8.3.1 - Commercial landuse (Amenities –II) and Public-Semi-Public landuse (Amenities –I)

A PSP plot including training, communication & telecommunication centres and multiple convenience shopping areas with ATM and PO facilities has been planned near white industrial plots. Two Senior Secondary schools, smaller school facilities, anganwadis, community centres and convenience shopping areas have proposed within walkable distance of these residential areas.

4.18.8.4 - Logistics land use– designated parking and logistics area

Small parking lots have been proposed near industrial plots, all parking facilities for residential shall be planned within residential premises as no on-street parking shall be encouraged.

4.18.8.5 - Open spaces landuse

The reserved forest block has been planned with a 50m plantation buffer which shall acts as a visual respite for residents within this land parcel. Multiple designated open spaces with recreation facilities have also been planned near residential landuses.

4.18.8.6 - Infrastructure utility landuse

Utility land parcels have been planned along the outer peripheral edges of this land parcel, however all about the main arterial road network. A consolidated area has been earmarked for STP in the south and another for summer storage tank in the central area have been planned for both residential and industrial landuses. Other utility plots for power, water supply and solid waste management have also been proposed within this land parcel.

Figure 4.50 – Focus Residential Areas in Komarolu Bit I

Top views of the residential areas proposed within the parcel

Source: Egis Analysis

Figure 4.51 –Komarolu Bit I Aerial views

Aerial views of the proposed residential areas along with the access road

Source: Egis Analysis

Figure 4.52 –Komarolu Bit I Aerial views

Views of the proposed residential areas along with the adjacent recreational spaces

Source: Egis Analysis

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6

DEVELOPMENT CONTROL REGULATIONS

6 - DEVELOPMENT CONTROL REGULATIONS

6.1 - Introduction

This chapter summarizes the review of the statutory development control regulations to bring about a cohesive development pattern and design element into the proposed development. The objective of the Development Control Regulations (DCR) is to promote and regulate development controls for building(s) within use premises in accordance with the development policies and land use proposals contained in the final master plan. These regulations shall be effective in Orvakal Industrial Area (OIA).

The entire Orvakal Industrial Area cannot be regulated by land use only. It must be supplemented by development regulations and urban design/landscape guidelines. Applicability of various aspects such as, Roads abutting plots, Building Heights, Parking, Amenities, Open spaces etc. will be part of this chapter. The regulations reviewed and presented in this chapter shall be guiding and shall facilitate development within OIA.

These regulations shall act as a mechanism to grant permissions to (prospective developers/ builders/ end-users / plot owners etc.) for creation of infrastructure facilities for their plots as also to implement the broad land use plan policies of the final master plan. These regulations will act as promotional as well as control the development to achieve the planned growth.

6.2 - Review of existing regulations

A review of the following key Andhra Pradesh government GOs is done to understand all prevalent development codes:

- G.O.Ms. No. 119, Dated : 28-03-2017, Model Building Bye- Laws 2016 of GoI – Andhra Pradesh Building Rules, 2017 ;
- G.O.Ms. No. 275, Dated : 18-07-2017, The Andhra Pradesh Land Development (Layout and Sub-division) Rules, 2017

A summary of essential requirements for obtaining land / layout development permission is as follows:

1. **Vicinity of Airport** - The building heights and other parameters shall be regulated as per the stipulations of the Airport Authority of India as notified in Gazette of India Extraordinary (S.O.1589) dated 30-06-2008 and as amended from time to time by Ministry of Civil Aviation, Government of India.
2. **Defense Establishments** - In case of Sites within 500m distance from the boundary of Defense Areas/Military Establishments prior clearance of Defense Authority shall be obtained.
3. **Electrical Lines** - In case of Electricity Tower lines, the land below the tower line to the width of tower base shall be developed as green belt and on either side of green belt there shall be a minimum of 10m wide roads or as defined in the Master Plan.
4. **Railways** - The distance between the Railway Property Boundary and the edge of the building shall be 30m as per Indian Railways Works Manual or as per No Objection Certificate (NOC) given by the Railway Authorities.
5. **Religious Structures** - In case of Sites located within a radius of 100m from the notified religious structure from time to time by the sanctioning authority, the construction is allowed up to 12m height only.
6. **Water Bodies** - The water bodies and courses shall be maintained as Recreational/Green Buffer Zone and no building activity / Land Development shall be carried out within - 9m from the FTL boundary of Lakes / Tanks / Kuntas of area less than 10Ha / shikamlands ; 9m from the defined boundary of Canal, Vagu, Nala, Storm Water Drain of width more than10m ; 2m from the defined boundary of Canal, Vagu, Nala, Storm Water Drain of width up to10m.
7. **Approach Road** - No plot in the layout shall get direct access from any National or State Highway or Ring Road or Expressways or any road which is proposed in the Master Plan or any other sanctioned plans as 30m or more in width. The access shall be through a service road of at least 12m wide which shall be proposed within the layout site.

8. In case of Commercial and Industrial Layouts, the minimum width of the road shall be12m. The minimum width of the roads with reference to the length proposed shall be as indicated in the Table below.

Table 6.1 - Essential requirements in terms of roads

SL. NO.	LENGTH OF THE ROAD (M)	MINIMUM ROAD WIDTH (M)	SPLAY REQUIRED (M)
1	Up to 600	12	3
2	Above 600 and up to 1000	18	5
3	Above 1000 And up to 2000	24	5
4	Above 2000	30	6

Source: Amendments of G.O.Ms.No.178, Dt.01-10-2020

9. **Reservation and Allotment of Land** - In layouts of above 5 ha : 3% of the layout area for Amenities and 1% of the layout area for Utilities ; 10% of the layout area for Public Open Space.
10. **Permissible Setbacks & Height Stipulations** for All Types of Non-High Rise Buildings

Table 6.2 – Permissible Setbacks and Height Simulations

SL. NO.	PLOT SIZE (IN SQM) ABOVE - UP TO	PARKING PROVISION	HEIGHT (IN M) PERMISSIBLE UP TO	BUILDING LINE OR MINIMUM FRONT SETBACK TO BE LEFT (IN M) ABUTTING ROAD WIDTH					MINIMUM SETBACKS ON REMAINING SIDES (IN M)
				UP TO 12 M	*ABOVE 12M & UP TO 18M*	*ABOVE 18M & UP TO 24 M*	*ABOVE 24M & UP TO 30M*	*ABOVE 30M*	
1	Less than 50	-	7	2	2	3	3	3	-
2	50 - 100	-	7	1.5	1.5	3	3	3	-
			10	1.5	1.5	3	3	3	0.5
3	100 - 200	-	10	1.5	1.5	3	3	3	1.0
4	200 - 300	Stilt floor	7	2	3	3	4	5	1.0
			10	2	3	3	5	6	1.5
5		Stilt floor	7	3	4	5	6	7.5	1.5

Table 6.2 – Permissible Setbacks and Height Simulations

SL. NO.	PLOT SIZE (IN SQM) ABOVE - UP TO	PARKING PROVISION	HEIGHT (IN M) PERMISSIBLE UP TO	BUILDING LINE OR MINIMUM FRONT SETBACK TO BE LEFT (IN M) ABUTTING ROAD WIDTH					MINIMUM SETBACKS ON REMAINING SIDES (IN M)
				UP TO 12 M	*ABOVE 12M & UP TO 18M*	*ABOVE 18M & UP TO 24 M*	*ABOVE 24M & UP TO 30M*	*ABOVE 30M*	
	300 - 400		12	3	4	5	6	7.5	2.0
6	400 - 500	Stilt floor	7	3	4	5	6	7.5	2.0
			12	3	4	5	6	7.5	2.5
7	500-750	Stilt floor	7	3	4	5	6	7.5	2.5
			12	3	4	5	6	7.5	3.0
			15	3	4	5	6	7.5	3.5
8	750 - 1000	Stilt +Cellar floor	7	3	4	5	6	7.5	3.0
			12	3	4	5	6	7.5	3.5
			15	3	4	5	6	7.5	4.0
9	1000-1500	Stilt +2 Cellar floor	7	3	4	5	6	7.5	3.5
			12	3	4	5	6	7.5	4.0
			15	3	4	5	6	7.5	5.0
10	1500 - 2500	Stilt+ 2 Cellar floors	7	3	4	5	6	7.5	4.0
			15	3	4	5	6	7.5	5.0
			18	3	4	5	6	7.5	6.0
11	Above 2500	Stilt + 2 or more Cellar floors	7	3	4	5	6	7.5	5.0
			15	3	4	5	6	7.5	6.0
			18	3	4	5	6	7.5	7.0

11. **Minimum abutting road width** and all-round open space/setback for High Rise Buildings

Table 6.3 - Minimum Abutting Road Width & setbacks for High Rise buildings

SL. NO.	HEIGHT OF BUILDING (M)		MINIMUM ABUTTING ROAD WIDTH (M)	MINIMUM ALL ROUND OPEN SPACE (M)
	ABOVE	UPTO		
A	B	C	D	E
1	-	21	12	7
2	21	24	12	8
3	24	27	18	9
4	27	30	18	10
5	30	35	24	11
6	35	40	24	12
7	40	45	24	13
8	45	50	30	14
9	50	55	30	16
10	After 55m 0.5m additional setback for every 5m of height shall be insisted			

Source: Amendments of G.O.Ms.No.178, Dt.01-10-2020

12. Parking Requirements in Buildings

Table 6.4 - Essential requirements in terms of roads

SL. NO.	CATEGORY OF BUILDING / ACTIVITY	PARKING AREA TO BE PROVIDED AS PERCENTAGE OF TOTAL BUILT UP AREA	
		MUNICIPAL CORPORATION & SELECTION GRADE, SPECIAL GRADE MUNICIPALITIES	FIRST GRADE, SECOND GRADE, MUNICIPALITIES, NAGAR PANCHAYATS & GRAM PANCHAYATS IN MASTERPLAN AREAS & IN DEVELOPMENT AUTHORITIES
A	B	C	D
1	Multiplexes	60	50
2	Information Technology Enabling Services Complexes of Non-Residential Categories	50	40
3	Business buildings, cinema halls, hotels, kalyana mandapams, lodges, offices, other commercial buildings,	30	25

Table 6.4 - Essential requirements in terms of roads

SL. NO.	CATEGORY OF BUILDING / ACTIVITY	PARKING AREA TO BE PROVIDED AS PERCENTAGE OF TOTAL BUILT UP AREA	
		MUNICIPAL CORPORATION & SELECTION GRADE, SPECIAL GRADE MUNICIPALITIES	FIRST GRADE, SECOND GRADE, MUNICIPALITIES, NAGAR PANCHAYATS & GRAM PANCHAYATS IN MASTERPLAN AREAS & IN DEVELOPMENT AUTHORITIES
A	B	C	D
	restaurants & high-rise buildings / complexes of non-residential category		
4	Colleges. Godowns, hospitals, industrial buildings, institutional buildings, residential apartment complexes. Schools, educational buildings, & other buildings	20	20

6.3 - Prescriptive guidelines

This section provides guidelines that seek positive design outcomes for a range of industrial, residential and commercial activities. It further includes :

- Volumetric Guidelines
- Mobility Guidelines

6.3.1 - Industrial land use

Table 6.5 - Prescriptive guidelines for Industrial Landuse

I. VOLUMETRIC

A. FSI (Floor- Space – Index)

1. *Maximum FSI*	
• Extensive Industries (All Industrial usesincluding Chemical, Flatted Factories)	*1.0
• Light & Medium Industrial (Service industries)	*1.0
2. *Landuse specific- Minimum or Maximum plot areas*	
• For manufacturing industrial units	*500 sq.m. & more

Table 6.5 - Prescriptive guidelines for Industrial Landuse	
• Canteens, transport offices, individual shopsfor industrial goods and services	*200 sq.m. & more
• Plots for convenience shopping units	• *50 to 60 sqm
• Informal shopping, stall sites	• *Upto 24m
3. *Maximum % of Open space*	• 60%
4. *Maximum building height*	• *18m
• Exempt from height limitations/ not included in building height	• Heavy machinery, tele-towers, temporary cranes etc
B. Setbacks	
1. *Front setback*	• 15m
2. *Rear & side setbacks*	• 12m
3. *Inter-building setbacks (to achieve inter-building shading and ventilation)*	• 15m
4. *From Water course or Forest buffers*	• *9m (minor water courses and forest boundary) and 15m (frommajor water courses)
5. *From adjoining land uses*	• 9m
6. *From designated Open spaces*	• 7.5m
C. Architectural interface	
1. *Fenestration percentage on external wall*	
• North facing and overlooking internal open greens	• 10%
• Rest – South, East & West facing	• 5%
2. *Legibility of Block entry and common vertical circulation points (stairs & lifts)*	• external wall surface to reflect change in material surface orcolour and height • Block entry through lobby area (min. 10sqm with letter box walls and guard seating or security access zone) • Lobby access door fire-rated and min. 1.8m
3. *Roof-top*	• Solar panels (to allow orientation for maximum solar gain)

Table 6.5 - Prescriptive guidelines for Industrial Landuse	
	• Provision for roof-top rainwater collection through concealed pipes (in shafts) or roof-top collection tank
II. **MOBILITY**	
D. Vehicular access points	
1. Approach access width within plot	• *Length of access: minimum width of road • upto 75m internal road: 6m • 76m to 150m internal road: 9m • 151m to 300m internal road length: 12m • Above 300m internal road length: 15m
D1. Flattened Group Industry	• Separate Entry and Exits of 9m driveways for heavy vehicles • 9m turning radius • Separate access to and from basements
D2. Light & Service Industries	• Security point and gate for Vehicles, cycles, pedestrian • Separate Entry and Exits of 9m driveways for heavy vehicles • 9m turning radius • Separate access to and from basements
D3. Extensive Industries	• Security point and gate for Visitors • Security point and gate for employee vehicles, pedestrian/ cycles& EVs • Separate Entry and Exits of 9m driveways for heavy vehicles • 9m turning radius • Separate access to and from basements
E. Internal mobility within plotted development	• shared bike parking • Car &visitor car parking • EV or shared Passenger transport parking and recharging station
F. Pedestrian access	
1. To open spaces and transport facilities (bus stops orEV stops)	• within 10 minutes or minimum 800m walking radii
2. To amenities	• Public toilets • Bank/ ATMS • Postal office • EV parking and Bus stops • Food outlets & vendor stalls

6.3.2 - Residential land use

Table 6.6 - Prescriptive guidelines for Residential Landuse

I. VOLUMETRIC

A. FSI (Floor- Space – Index)

1. *Maximum FSI (including Residential Hotels, less than15m and up to 500 sqm)*	• *1.0
2. *Landuse specific- Minimum or Maximum plot areas*	•
• Low-income group and EWS Housing	• *20 Sq.m plot area with a minimum width of 3.5 m
• Row Housing	• *50 to 100 sqm
• Semi-detached housing	• *150 to 200 sqm
• Detached type housing	• *Above 200 sqm
3. *Maximum % of Open space*	• 70%
4. *Maximum building height*	• *10m (plotted housing) • 12.5m (group housing, including ground level stilted parking)
• Top of Mumpty	• ^3m from terrace floor finish

B. Setbacks

1. *Front setback*	• *Min. 3m (plotted housing; including detached & row housing)7.5m from plot boundary (for group housing)
2. *Rear & side setbacks*	• *Min. 3m (plotted housing; one-side for detached & 0m sidesetback for row housing) • 9m from plot boundary (for group housing)
3. *Inter-building setbacks (to achieve inter-building shading and ventilation)*	• *12m
4. *From Water course or Forest buffers*	• *9m (minor water courses and forest boundary) and 15m (frommajor water courses)
5. *From adjoining land uses*	• 9m
6. *From designated Open spaces*	• 7.5m
7. *Street setbacks* • To achieve desired vision plate and exposureplane	• *Min. 3m (for plotted housing plots) and 9m (for cluster/

Table 6.6 - Prescriptive guidelines for Residential Landuse	
• Maximum daylight/ shading	group housing plots) • *1.5m set from internal roads, min. 7.5m (FTP) along boundary or/and podium; above 24m (G+7) = 8m; above 37.5m (G+11+S) = 12m
C. Architectural interface	
1. *Fenestration percentage on external wall*	
• North facing and overlooking internal open greens	• 20-25%
• Rest – South, East & West facing	• 10-15%
2. *Legibility of Block entry and common verticalcirculation points* (stairs & lifts)	• external wall surface to reflect change in material surface or color and height • Block entry through lobby area (min. 10sqm with letter box wallsand guard seating or security access zone) • Lobby access door fire-rated and min. 1.8m
• Blank walls (if any)	• To be used as Street-art surface
3. *Roof-top*	• Solar panels (to allow orientation for maximum solar gain)
	• Provision for roof-top rainwater collection through concealedpipes (in shafts) or roof-top collection tank
II. MOBILITY	
1. *Complex entry ramps and widths (plotted housing)*	• *Plotted complex entry* ○ Limit complex entry from or tertiary secondary access roads ○ Access points to have provision for security post and RFID gates ○ Way- finding signages at street junctions and entry of public spaces.
	• *Plot entrance* ○ Allow 3m vehicular access (from plot boundary edge) ○ Alternating sides, to allow shared ramps (6m) from access roadinto plots ○ All 6m access ramps to be atleast 10m away from streetjunctions
2. *Complex entry ramps and widths (group housing)*	• Allow two-way vehicular access • Arrival point with legible wayfinding & map • Limit complex entry from or tertiary secondary access roads • Access points to have provision for security post and RFID gate. • Way- finding signages at internal street junctions and entry ofpublic spaces/ amenities.

Table 6.6 - Prescriptive guidelines for Residential Landuse	
E. Internal mobility within plotted development	• shared bike parking • Car &visitor car parking • EV or shared Passenger transport parking and recharging station
F. Pedestrian access	
1. *To open-spaces*	• within 5 minutes or minimum 400m walking radii
2. *To transport facilities (bus stops or EV stops)*	• within 10 minutes or minimum 800m walking radii
3. *Access to amenities*	• Public toilets • Bank/ ATMS • Postal office • EV parking and Bus stops • Food outlets & vendor stalls

6.3.3 - Commercial land use

Table 6.7 - Prescriptive guidelines for Commercial Landuse	
I. VOLUMETRIC	
A. FSI (Floor- Space – Index)	
1. *Maximum FSI (including Residential Hotels, less than15m and up to 500 sqm)*	• *1.0
2. *Landuse specific- Minimum or Maximum plot areas*	
• Low-income group and EWS Housing	• *20 Sq.m plot area with a minimum width of 3.5 m
• Row Housing	• *50 to 100 sqm
• Semi-detached housing	• *150 to 200 sqm
• Detached type housing	• *Above 200 sqm
3. *Maximum % of Open space*	• 50%
4. *Maximum building height*	• *10m
• Top of Mumpty	• ^3m from terrace floor finish

Table 6.7 - Prescriptive guidelines for Commercial Landuse

B. Setbacks	
1. *Front setback*	• 0m (for retail frontages, without projections); 9m (for offices)
2. *Rear & side setbacks*	• 9m
3. *Inter-building setbacks (to achieve inter-buildingshading and ventilation)*	• *12m
4. *From Water course or Forest buffers*	• *9m (minor water courses and forest boundary) and 15m (frommajor water courses)
5. *From adjoining land uses*	• 9m
6. *From designated Open spaces*	• 7.5m
7. *Street setbacks* • To achieve desired vision plate and exposureplane • Maximum daylight/ shading	• *Min. 3m (for plotted housing plots) and9m (for cluster/ group housing plots) • *1.5m set from internal roads, min. 7.5m (FTP) along boundary or/and podium; above 24m (G+7) = 8m; above 37.5m (G+11+S) = 12m
C. Architectural interface	
1. *Fenestration percentage on external wall*	
• North facing and overlooking internal open greens	• 20-25%
• Rest – South, East & West facing	• 10-15%
2. *Legibility of Block entry and common verticalcirculation points* (stairs & lifts)	• external wall surface to reflect change in material surface or color and height • Block entry through lobby area (min. 10sqm with letter box wallsand guard seating or security access zone) • Lobby access door fire-rated and min. 1.8m
• Blank walls (if any)	• To be used as Street-art surface
3. *Roof-top*	• Solar panels (to allow orientation for maximum solar gain)
	• Provision for roof-top rainwater collection through concealedpipes (in shafts) or roof-top collection tank
II. MOBILITY	
D. Vehicular access points	

Table 6.7 - Prescriptive guidelines for Commercial Landuse	
1. *Minimum Road access width*	
2. *Complex entry ramps and widths*	
D1. Commercial or Retail Entry	• Access, parking and unloading for commercial uses to be limitedto service lane off 30m or wider roads • All unloading to be from rear access road (min. 9m wide)
D2. Separate access for Commercial	• Allow one-way separate entry and exits for vehicular access • All parking in basements • shaded pedestrian pathways to access points at ground level
D3. Separate access for retail uses	• Allow one-way separate entry and exits for vehicular access • Parking in basement, drop off near retail-plaza with emergencyaccess for FTP • Pedestrian access/ pathways to retail shops from drop-off, to beshaded with semi-covered structures or tree foliage.
E. Internal mobility within plotted development	• shared bike parking • Car &visitor car parking • EV or shared Passenger transport parking and recharging station
1. *To open-spaces*	• within 5 minutes or minimum 400m walking radii
2. *To transport facilities (bus stops or EV stops)*	• within 10 minutes or minimum 800m walking radii
3. *To amenities*	• Schools (Creche, Primary and Sr. Sec. schools) • Community halls/clubs • Public toilets • Bank/ ATMS • Postal office • EV parking and Bus stops • Food outlets & vendor stalls

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7

BROAD COST ESTIMATES

7 - BROAD COST ESTIMATES

7.1 - Introduction

This chapter summarizes the broad cost estimates for the proposed basic infrastructure works in Orvakal Industrial Area. The broad costs have been estimated by the project team for the purpose of preparing the preliminary financial model, which is to be submitted with this deliverable. It is to be noted that these estimates are to be considered as a Rough Order of Magnitude (ROM) typically used during planning stages of an assignment for evaluation purposes.

These estimates are not based on engineering designs, which will be commenced in subsequent stage of Draft Preliminary Designs (KD-9). Therefore, these estimates are prepared with benchmarks, established industry practices, procurement rates approved by the government departments and experience of similar projects elsewhere in India.

7.2 - Proposed Infrastructure Works

The broad cost estimates described in the following sections are prepared by using the costs of potential projects for transportation and infrastructure services/ utilities which might later be identified as high priority and taken up for execution.

The proposed infrastructure works at site covers the following major infrastructure heads which are considered as essential for optimal development of Orvakal Industrial Area:

- **Road Works :** includes development of internal trunk roads, including road grading through excavation and filling and creation of formation levels.
- **Storm drainage :** includes creation of storm drainage network along roads, outfall structures, creation of storm water sinks at select locations across the site and development of rainwater harvesting structures at site level.
- **Bridges/ Culverts :** Development of minor bridges/ culverts within the site.
- **Water Supply :** Potable and recycled water cost includes development of water treatment works and potable and recycled water networks within the site. It also includes provision for water transmission mains.
- **Sewerage and Effluent :** Sewerage and effluent treatment costs include development of sewerage and effluent conveyance network including domestic sewage treatment plants and industrial effluent treatment plants at site.
- **Electrical Distribution :** Electrical distribution system includes creation of MRSS/ ZSS/ ESS at 220/ 33kV along with development of distribution networks within site.
- **ICT and SCADA :** costs include provision of smart solutions, telecom and data for the project site including Command and Control centre, fibre-optic cable backbone, data centre and recovery.
- **Solid waste management** covers development of an integrated municipal solid waste management system including material recovery facility, collection and transportation facilities at site.
- **Landscape :** covers the major site level landscape works such as streetscape and area level landscape works.

7.3 - Summary of Broad Cost Estimates

The summary of broad cost estimates is given in Table 7.1 for ready reference and covers the costs for development of infrastructure works. Other costs including escalation, pre-operative costs etc. have been considered in the next chapter, i.e., preliminary financial analysis.

The cost for internal infrastructure development works in the project is estimated at Rs. 3807.90 Crores excluding the development area of 413.19 Acres of Jai Raj Ispat- existing industry. Based on land bifurcation proposed between NICDC and APIIC, the project cost is estimated at Rs. 2064.70 Crores and Rs. 1743.20 Crores respectively for development under NICDIT framework and APIIC framework.

Table 7.1 – Broad Cost Estimates for Orvakal Project

S. NO.	NICDC SHARE (IN CR.)	APIIC SHARE (IN CR.)
External Infrastructure		
External Road Connectivity		106.5
Internal Infrastructure		
Roads	309.6	233.3
Storm water Drains and Outfalls	84.9	74.9
Bridges	48.0	45.3
Culverts	14.7	29.7
Water supply	240.9	49.8
Sewerage and effluent	751.3	864.6
Power	416.1	306.3
ICT & SCADA	52.5	30.0
Solid waste	21.0	20.0
Landscape	124.4	87.8
Boundary Fencing	1.4	1.5
TOTAL (Internal Infra)	**2,064.7**	**1,743.2**

Source: Egis Analysis

The Orvakal Node is not contiguous and comprises of different land parcels. The project cost is accordingly worked out for each parcel separately and given in Table 7.2 below.

Table 7.2 – Broad Cost Estimates for Orvakal Project (by land parcel)

S. NO.	NICDC SHARE (IN CR.)	APIIC SHARE (IN CR.)
External Infrastructure		
External Road		106.5
Internal Infrastructure		
Guttapadu Cluster	1326.6	1111.6
Pudicherla	-	159.0
Kannamadakala	-	64.2
Palakolanu	-	-
Komarolu Bit-1	306.7	-
Komarolu Bit-2	-	234.2
Brahmanapalle	-	174.2
Somayajulapalle	431.4	-
TOTAL (Internal Infra)	**2,064.7**	**1,743.2**

Source: Egis Analysis

The above cost estimates do not include the cost for development of internal infrastructure for proposed MMLH at Orvakal and Palakolanu, which are envisaged to be developed by the SPV and APIIC respectively, under PPP framework.

Broad cost estimates for the three identified land parcels to be developed under NICDIT framework are given in Table 7.3 below. Total road lengths for NICDC parcels of Guttapadu (South), Komarolu Bit 1 and Somayajulapalle are 34.2km, 15.3km and 7.1km respectively.

Table 7.3 – Broad Cost Estimates for internal infrastructure in NICDC land parcels (IN CR.)

S. NO.	GUTTAPADU	KOMAROLU BIT 1	SOMAYAJULAPALLE
Internal Infrastructure			
Roads	202.6	72.2	34.8
Storm water Drains and Outfalls	54.3	20.6	10.0
Bridges	30.0	12.0	6.0
Culverts	5.3	4.2	5.3
Water supply	204.2	22.0	14.7
Sewerage and effluent	483.7	43.0	224.6
Power	250.8	89.1	76.2
ICT & SCADA	30.0	15.0	7.5
Solid waste	15.0	1.0	5.0
Landscape	50.2	27.1	47.1
Boundary Fencing	0.5	0.5	0.4
TOTAL	**1,326.6**	**306.7**	**431.4**

Source: Egis Analysis

Broad cost estimates for the five land parcels to be developed under APIIC framework are given in Table 7.4 below. Total road lengths for APIIC land parcels of Guttapadu (North), Brahmanapalle, Komarolu Bit 2, Pudicherla, Kannamadakala are 28.5km, 11.6km, 11.1km, 11.5km and 3.6km respectively.

Table 7.4 – Broad Cost Estimates for internal infrastructure in APIIC land parcels (IN CR.)

S. NO.	GUTTAPADU	BRAHMANAPALLE	KOMAROLU BIT 2	PUDICHERLA	KANNAMADAKALA
Internal Infrastructure					
Roads	129.2	28.8	29.3	35.0	11.0
Storm water Drains and Outfalls	36.8	10.4	11.0	12.7	4.0
Bridges	18.0	4.8	12.0	7.5	3.0
Culverts	13.1	4.2	5.7	5.4	1.3
Water supply	24.6	6.9	6.7	7.0	4.6

Table 7.4 – Broad Cost Estimates for internal infrastructure in APIIC land parcels (IN CR.)

S. NO.	GUTTAPADU	BRAHMANAPALLE	KOMAROLU BIT 2	PUDICHERLA	KANNAMADAKALA
Sewerage and effluent	693.1	54.3	76.6	26.5	14.0
Power	128.0	46.6	66.3	46.8	18.7
ICT & SCADA	15.0	5.0	5.0	3.5	1.5
Solid waste	10.0	3.0	3.0	3.0	1.0
Landscape	43.4	10.1	18.3	11.2	4.8
Boundary Fencing	0.4	0.2	0.3	0.3	0.2
TOTAL	**1111.6**	**174.2**	**234.2**	**159.0**	**64.2**

Source: Egis Analysis

External trunk road development required for development of Orvakal Industrial Area is given in Table 7.5 below.

Table 7.5 – Broad Cost Estimates for external ROAD (IN CR.)

S. NO.	EXTERNAL ROAD COST (IN CR.)
Guttapadu	27.0
Komarolu Bit 1	22.5
Somayajulapalle	9.0
Brahmanapalle	16.5
Komarolu Bit 2	15.0
Pudicherla	9.0
Kannamadakala	7.5
TOTAL	**106.5**

Source: Egis Analysis

Communication

egis-india@egis-india.com

www.egis-group.com

egis

5.2 - Drainage

5.2.1 - Objective of SWM

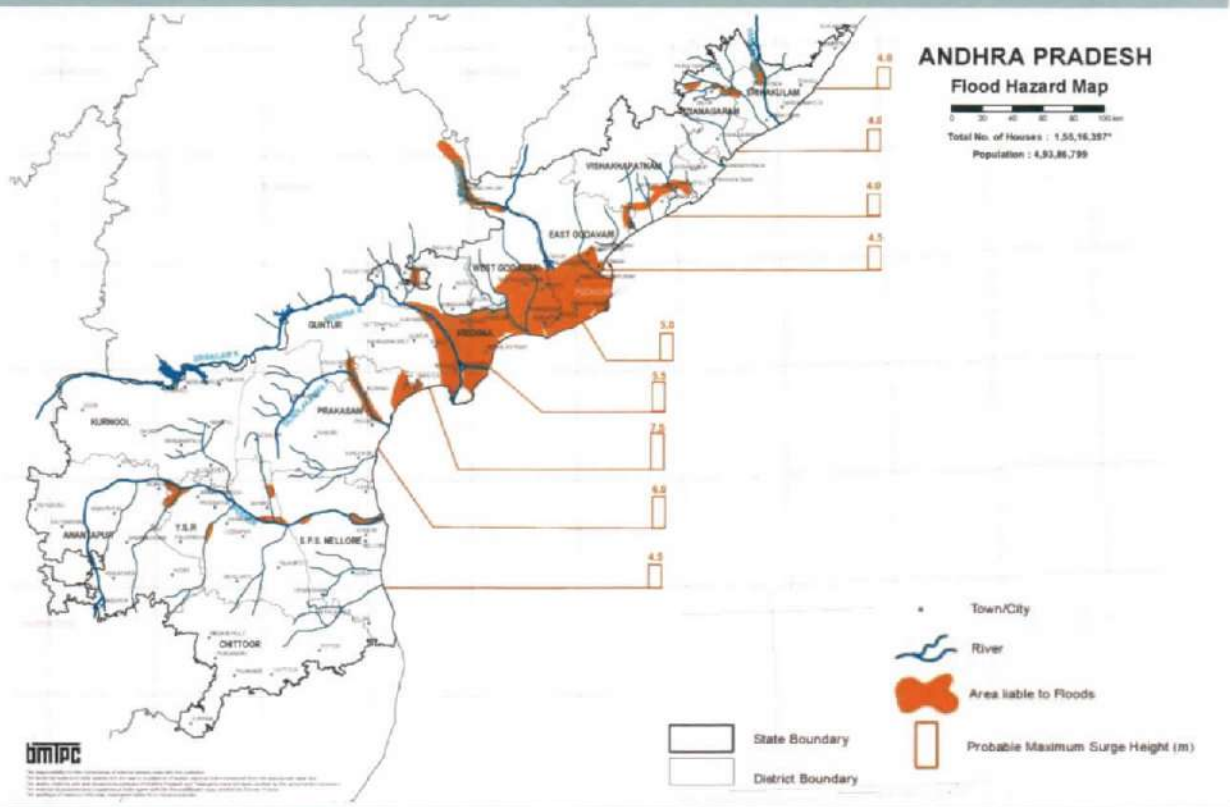
The main objective of this section is to provide a preliminary concept with respect to flood hazards, precipitation, and storm water drainage system. It is not intended to produce a technical design at present stage, as it is subject to change later based on the graded levels of Final Approved Masterplan layout for this project. For this stage, following key points related to drainage scheme are discussed.

- Regional inundation and flood vulnerability
- Food hazard assessment of site and surrounding area
- Existing drainage across project site
- Proposed storm water management concept and SWM network
- Proposed Storm water management schemes
- Storage facilities
- Ground water recharging

5.2.2 - Regional inundation and flood vulnerability

As per National Disaster Management Guidelines for management of floods by Government of India, Vulnerability Atlas of India, was released by BMTP (third edition in 2019) for the state of Andhra Pradesh. The state holds up to 1.39 million hectares of area that comes under flood prone zones, making the state the second most vulnerable state after Kerala. However, the Kurnool district and Orvakal Mandal do not come under high flood vulnerability zones within the AP state flood vulnerability map.

Figure 5.5 - Flood hazard Map



Source: BMTPC (https://bmtpc.org/DataFiles/CMS/file/VAI2019/ap.html)

As part of Andhra Pradesh Hazard Mitigation and Emergency Cyclone Recovery project (CERP), the Andhra Pradesh state remote Sensing application Centre (APSRSAC), the Department of statistics and Planning, GoAP, had prepared several 100-year return period maps for all major river systems in 2010. After devastating flash-floods in Kurnool District that lies on southern banks of Tungabhadra, in October-November 2009, the district had witnessed heavy discharge of over 2lakhs cusecs of flood water, 5 times the average water discharge from Tungabhadra and Handri Rivers. Findings from this flood were highlighted and measures were taken with establishment of reservoirs in and around the district. Subsequently, State government of Andhra Pradesh's Disaster Management Authorities (APDMA) illustrated in their Disaster management plan 2017-2018, both flood inundation maps of Major and Minor rivers across Andhra Pradesh state and the said region on Kurnool comes under non-flood –prone areas.

5.2.3 - Proposed concept of Storm-water Drainage Scheme

Specifically in inland areas like said project region, an increase in water levels along certain riverbanks or reservoir, due to heavy rains, high winds, or dam bursts, causes temporary inundation of large regions, which are termed as floods.

The main purpose of drainage is to remove the excess surface water as quickly as possible, especially during these floods and ensure no drainage congestion or contamination occurs across the site despite proposed development. To avoid drainage congestion, the capacity of the drainage channels and regulatory structure at the outfall needs to be maintained adequately and ensure the ruling level of water at the outfall cannot become too high for the stagnant water to drain off. Especially, across commercial and industrial areas this undrained accumulated water can adversely affect water quality in addition to the disruption to communications and transport, damages properties and causes general dislocation.

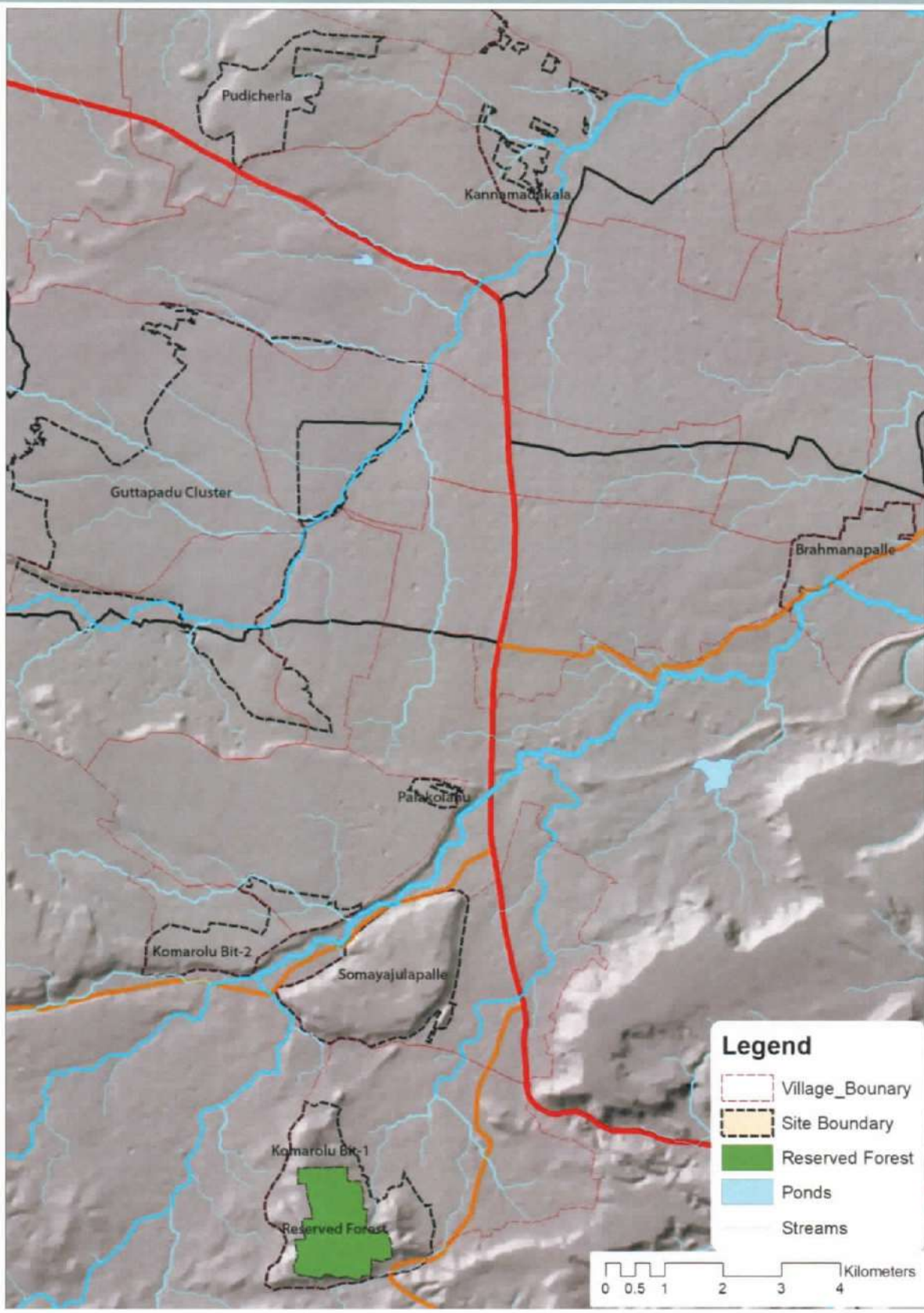
To understand the existing drainage in and around the project site, all water streams crossing, flow directions, their capacities, especially at outflow points were studied and analysed for ensure rainwater harvesting and reduce any flood probabilities further.

5.2.4 - Existing drainage

Guttapadu being the largest consolidated land parcel has many streams intersecting and flowing into the KC (Kurnool-Cuddapah) canal and Komarolu Bit-2, also has multiple small streams intersection it. Most other land parcels fewer streams intersect the land parcels. Very few small ponds exist across land parcels, to retain the storm water for drinking and irrigation purpose. The project site area surface and sub surfaces are mainly containing the rocky strata. The percolation of rainwater through surface is very minimal and heavy runoff will be occurring during the rainy seasons in the form of sheet flows. Topography of the Orvakal Industrial site varies from one land parcel to other. The Existing topography of each industrial cluster is represented in an overall drainage map in previous section.

Below figure shows existing storm drainage channels in project site.

Figure 5.6 - Existing drainage



Source: Egis Analysis

5.2.5 - Proposed Storm water management concept and SWM network strategy

Although majority of storm water gets collected through KC canal, there catchments are primarily utilised by local people for irrigation and agriculture purpose. Storm water management becomes essential for Industrial areas like OMIH, to ensure:

- Essential to protect the existing water retention check dams along the Kundhu stream.
- No disruption or contamination of water to areas falling in downflow areas of the KC canal
- Ground water recharge to rationalised and minimize raw water demand by project
- Adequate capacities along existing and support grey infrastructure to ensure least risk or probability to floods in and around project area

Hence, Storm water management becomes essential for Industrial areas like OMIH. This section proposes a SWM strategy to provide storm water catch basins in each cluster and help in reduce the water demand and utilised for other industrial purposes. Proposed SWM strategy will illustrate of planned drainage system for the proposed development.

5.2.6 - Storm Drainage Catchments

Based on the proposed land use map, the entire site is divided into 9 drainage catchment zones. Potential water storage sites have been identified for each zone by utilising the existing available water body such as river, nallah, water tank or reservoir for the purpose of storing surface water runoff within that zone. Proposed drainage catchments map is prepared for Final Master Plan based on the land use pattern, sub-division, road network and topography.

5.3 - Sewerage & Effluent Collection System

5.3.1 - Site Topography

Except for the southernmost parcels of Komarolu bit-II, Somayajulapalle, and Komarolu Bit-I, which have undulating topography with gentle to mild slope, the topography of all the parcels is generally flat with plateau-like sections and has a gradual slope of 2.5 percent from north-west to south-east. The access road from the west side creates a gradual elevation increase in the northernmost portion of the project site, Pudicherla, while the remaining topography is rather flat within the rest of the land parcel. Kannamadakala, which is south-east of the Kurnool airport, and the Brahmanapalle parcel both have a comparatively flat landscape.

Guttapadu's contiguous parcel features a moderate sloping landscape with less streambed depressions. A cliff-like structure with an elevation drops of 20-30 metres at the southwest boundary of this Guttapadu piece leads to a passing stream outside the land parcel. Somayajulapalle and Komarolu Bit II parcels feature a plateau-like topography with a minor undulation. Outside of the reserve forest area, the Komarolu Bit I land parcel includes an undulating topography with a Hillock feature in the south-east and a cliff along the project's western boundary.

Digital Elevation model indicating the existing site elevations has been as represented in Figure 2.5 (Chapter – 2, Context)

5.3.2 - Existing Sewerage System

Based on interactions with local's information collected during site visit, it was understood that no sewerage system exists in the project surrounding villages, All the toilets are dry pit type. Sullage water is disposed to the sewer network through house connection. Sullage is disposed outside the house and flows in open areas/ open drains. Sullage from some of the houses is connected to sewer network of with RCC pipes.

5.3.3 - Sewerage Unit Loads

Unit loads per capita sewage generation rates have been based on per capita water demand as per CPHEED sewerage manual, 2013 latest edition). Per capita water demand is further bifurcated into portable water and

non-portable water requirement. Similarly, per capita sewage flow is estimated per source of generation i.e., either from possible or recycle water use.

The design of sewerage systems is carried out assuming the 80% of net water supply, 65% of Ondustrial process supply will be contributing as sewerage. The infiltration is considered as 10% of total sewerage generation on average flow basis.

5.3.4 - Sewerage generation Estimation

Tentative sewerage generation estimation has been carried out for Orvakal for ultimate development. Considering the per capita sewage flows as mentioned in previous section, the estimated sewage generation is worked out is inclusive of infiltration flow. Recycled water will be reused for horticulture and flushing.

Note: For water demand estimation, please refer water supply section.

5.3.5 - Norms for Sewage Generation

The norms as given in Table 5.12 will be adopted for Sewage generation calculations.

Considering the above norms demand will be estimated for following recycled water, Industrial effluent and sewer Generations will be estimated.

Table 5.3- Per capita per day Sewage flows

S.NO.	LANDUSE	UNIT	WATER DEMAND		RETURN FACTOR		TYPE
			POTABLE	RECYCLE	PORTABLE	RECYCLE	
1	Residential	lpcd	105	45	80%	100%	Sewage
2	Floating	lpcd	15	30	80%	100%	Sewage
3	Hospitals	per bed	450		80%		Sewage
4	Industry - Employees	Lpcd	15	30	80%	100%	Sewage
7	Industry - Process Water	KL/Ha/day		15		65%	Effluent
8	Chemical – Heavy water-based Industries	KL/Ha/day		15		65%	Effluent
9	Community facilities	lpcd	15	30	80%	100%	Sewage

Source: Egis Analysis

5.3.5.1 - Sewage collection Benchmarks indicators

International benchmarks in reference to sewage network has been summarized in table below

Table 5.4: Benchmarked indicators

OBJECTIVE	OUTCOME
100% Coverage of Sewer Network	Availability of sewerage disposal will ensure higher quality of life and good protection against diseases among the residents of the city.
100% Reclaimed Water	To reduce the dependence on fresh water, Wastewater is reclaimed and supplied for non-potable purpose such as landscaping, DG Cooling, Flushing etc.
Zero Liquid discharge	To prevent pollution of existing natural water bodies, thereby reducing pollution impacts on downstream areas.
0% Pumping of Sewage	To reduce dependence on power and keep system functional under gravity to the maximum possible
Self Sufficiency in Electricity Needs	Solar power may be utilized wherever possible i.e., internal lighting of STP campus

Source: Egis Analysis

5.3.6 - Proposed Zoning

There are basically separate sewers, combined sewers, pressurized sewers and vacuum sewers. The proposed Industrial development will be a combination of Gravity & Pressurized system according to the design.

For planning of sewage and effluent collection and treatment systems, following zoning criteria have been considered:

- Existing topography
- Rising line
- Physical features like national or state highway, cross-drainage works, major water bodies, etc.
- Suitability & availability of sufficient land for STP(s) / CETP(s)

The zoning for wastewater network Orvakal Industrial Area has been done majorly on the basis of natural stream crossing from the project area & also based on the depth of manhole. The area between two natural streams has been considered under one zone. The wastewater network in the project area shall not cross from below the stream bed through gravity. Hence, by not allowing waste water network to cross through the stream has resulted in increased no. of Intermediate pumping stations (IPS). The above said consideration shall effect the overall project cost, but it has been adopted for the EC mandate and clearances.

Since the terrain is challenging and also because of the natural stream flowing from inside of the project area there is increase in total no. of IPS in Orvakal Industrial Project area. The wastewater from this IPS after pumping it to nearest gravity manhole the wastewater shall be finally discharged at CETP.

The wastewater network has been designed in a way that it caters the phasing requirement i.e. wastewater network pipeline can be extended for future phasing development.

5.3.7 - Proposed Wastewater System

Proposed project area consists of both industrial area and residential areas. The purpose for Wastewater Collection network is to collect industrial Waste from Industrial area and also the waste generated from residential and mixed use area to avoid any risk to civic health, safety and surrounding environment. Also the collection of wastewater will be done in through single network.

5.3.7.1 - Sewerage / Industrial Effluent Generation

Sewage generation for the proposed project are based on the following assumptions. The capacity of STP and CETP will be dependent on below assumptions and sizes will be finalised based on Industrial effluent generation estimates.

Table 5.5 - Assumptions for Sewage / Industrial Effluent

S.NO.	SEWAGE GENERATION	%	REFERENCE
	OVERALL		
1	Sewage generation expressed as percentage of potable water supplied	80%	As per CPHEEO Manual
2	Sewage generation expressed as percentage of recycled water supplied	100%	Assumption
3	Recovery of recycled water (treated sewage) from STP	90%	Assumption
	INDUSTRIAL		
4	Industrial effluent generation expressed as percentage of potable water supplied	80%	Assumption
5	Sewage generation expressed as percentage of recycled water supplied	100%	Assumption
6	Industrial effluent generation expressed as percentage of recycled water supplied for process water	65%	Assumption
7	Recovery of industrial effluent from CETP	90%	Assumption
8	Infiltration (as percentage of total wastewater generation)	10% Max	Assumption

Source: Egis Analysis

Since the development is planned to be of the highest standards, all systems must be extremely reliable. The latest echnology based system shall be provided in all the components. The significant variation in group elevation levels demonstrated major challenges in planning of gravity-based network. Natural topography and planned grade levels shall be considered while planning gravity-based sewerage and effluent network to minimize depth of sewers. Sewerage and effluent collection networks shall be planned with an aim to make best possible use of topography of the project site to develop a holistic and cost-0effective approach.

The effluent generated from industries within the project area shall be conveyed to the Common Effluent treatment Plant (CETP) shall be proposed to collection network. CETP shall be proposed to treat the effluents from Industries. The effluent from industries shall be pre-treated as per norms before discharging in effluent network for further treatment at CETP. Potential reuse of treated effluent from CETP shall be explored within industries for process and non-process utilization.

5.3.7.2 - Proposed Wastewater Collection Network

Wastewater generated from the project can be classified as sewage and industrial effluent. Though characteristics of the wastewater are entirely different, methodology of collecting of both the type of waste shall be same. A separate combined system is envisaged for collection of wastewaters generated by both industrial and sewage. A piped network will be proposed to collect wastewater from each plot. Each plot shall have a plot connection to dispose of the waste to the main network. The main wastewater network shall collect the waste and shall discharge in CETP / STP.

5.3.7.3 - Proposed Sewerage and Industrial Effluent Treatment System

Wastewater shall be treated suitably to be fit for recycling. The location of CETP and STP shall be assessed based on natural gravity flows in order avoid pumping systems.

Industries of White & Green Categories shall discharge its effluent into combined sewer [Sewage + Industrial Effluent] without Pre-treatment while the Industries of Orange & Red categories shall have the Pre-treatment units upto the standard as prescribed above respectively before discharging their effluent into Common sewer. The combined effluent emanating from all the industrial units with categories of [Red+ Orange + Green + White] along with domestic sewage shall be conveyed through common piping network to Common Effluent Treatment Plant [CETP] for its final treatment. Then treated effluent shall be recycled/disposed off as per site condition conforming to norms prescribed by MOEF [CC]/CPCB.

STP and CETP shall be designed to treat the wastewater to tertiary level and then transmission of treated effluent to recycled water MBR for reuse.

As a step towards sustainability, project will aim to achieve zero discharge. Hence, effluent generated from industries, domestic and commercial uses shall be reused. The effluent treated to the tertiary level will be used for gardening, flushing, firefighting, process water in industries etc.

Considering achieving zero discharge, Net recycled water availability and deficient will be estimated from Gross Recycled water demand and Net Recycled water demands also from Total Sewage generations, effluent generations, treated water recovery from STP and CETP. For the tentative location of STP and CETP please refer infrastructure strategy section. The exact positions and sizes will be assessed in next stage of design report.

5.3.8 - Proposed sewerage zones

Based on the proposed land use, the entire project area gets divided into 3 STP zones serving non- industrial area in Pudicherla, Guttapadu cluster and Komarolu Bit-1. However, 2 CETP zones have been established based on the national highway NH-40. While CETP-1 at Pudicherla cluster, on the north shall cater to Green and White industries; CETP-2, in Guttapadu Cluster, being central, shall cater to heavy, medium, and light industries. Capacity and area requirements for each parcel are worked out and given in following table:

Table 5.6 – Proposed Sewerage Zoning from Final Master Plan

CLUSTER	STP (MLD)	CETP (MLD)
Guttapadu		18.7
Pudicherla	3.6	
Kannamadakala	2.4	
Brahmanapalle		1.2
Somayajulapalle		3.4
Komarolu Bit 1	5.6	
Komarolu Bit 2		1.8
Total	**11.6**	**25.1**

Source: Egis Analysis

5.3.9 - Treatment Process CETP/STP

Treatment of High TDS effluent: -

The CETP has the following facilities to treat the High TDS effluent generated by the member industries, which is transported through pipeline to the CETP. The High TDS effluent shall be collected through an underground pipeline from the member industries into a sump. It is treated in API separator, equalization tank, stripper, multiple effective evaporators and spray drier. Multiple Effect Evaporator [MEEs] of shall be provided in the CETP for disposal of the HTDS effluent. The concentrate from the MEE shall be sent to the spray drier. In the spray drier, a scrubber shall be provided to minimize the salt emissions from the stack. The condensate of MEE is mixed with LTDS effluent for further treatment in the common ETP.

Treatment of low TDS effluent:-

The common ETP consists of Collection sump, API Separator, Equalization tanks, Air stripper, Clariflocculator, mixed high rate suspended solids contact clarifier (MHR SSC), sequential batch reactor (SBR), filter feed tank, sludge thickener, sludge centrifuge, sand filters, carbon filters, and guard ponds. The capacity of the common ETP is 3500 KL/day. The treated effluent is discharged through an underground pipeline into the marine outfall.

STP :-

Following Four Biological Treatment Processes are considered as they are suitable to meet the following objectives for the CETP:

- Activated Sludge Process-Extended Aeration (EA) with Tertiary Treatment
- Moving Bed Bio Reactor (MBBR) with Tertiary Treatment
- Sequencing Batch Reactor (SBR) with Tertiary Treatment
- Membrane Bio Reactor (MBR)

The above treatment processes for CETP & STPs are only indicative; However exact treatment process/technology shall be selected, designed and executed by the Concessionaire/Third Party engaged by the Client.

5.4 - Solid waste management

5.4.1 - Introduction

The term Municipal solid waste (MSW) is generally used to describe most of the non-hazardous solid waste from a city, town or village, Municipal Solid waste consists of commercial, Institutional, and residential wastes generated in a municipal or notified area in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes.

Solid waste in the Orvakal Industrial area may be divided into two major stream as per above stipulated rules. The streams are:

1. Municipal Solid Waste and
2. Industrial Waste.

For the designing of integrated solid waste management system, it is essential to identify the source of waste, estimate the waste quantity and characterise the waste. Existing waste generation in nearby villages are shown in below figures. The local are dumping the solid waste near the outskirts of villages and roadsides.

5.4.2 - Source of Solid Waste Generation

The tentative source of solid waste generation for the Orvakal Industrial area would be:

- **Residential :** Waste generation from residential area.
- **Commercial :** Waste from commercial spaces like shops, offices, malls, banks etc.
- **Biomedical :** Waste from the hospitals, clinics, and nursing homes etc.
- **Industrial :** Waste generated from the industry as à part of their industrial process.
- **Hazardous :** Waste that is hazardous in nature and can be generated from residential, commercial as well as Industrial area.
- **Street Sweeping & Garden waste :** Waste generated from street sweeping and landscaping. This also includes sewerage sludge etc.
- **Construction Waste :** Construction and demolition waste consists mainly of concrete, asphalt, stone, and wood.
- **Sludge from ETPs :** This also includes sewerage sludge, chemical sludges etc.

- **Slaughter House :** Organic Waste generated from the remains of the slaughter houses.

5.4.3 - Estimated Municipal Solid Waste

Estimated Municipal solid waste generation from the Orvakal Industrial area is approximate 56 TPD considering 42815 residential populations, working population 154768.

Total Municipal solid waste generation calculated based on residential population, working population and street sweeping waste. Broader consideration for estimation MSW is tabled below.

Table 5.7:Assumptions for Municipal Solid Waste

S.NO.	MSW GENERATION	PER CAPITA WASTE GENERATION AS PER CPHEEO MANUAL 2000
1	Residential Population	350gms
2	Working population and floating population	200gms
3	Roads : Street sweeping wastes	50gms

Source: Egis Analysis

Table 5.8 – Total Municipal Solid Waste Generation

S.NO.	MSW GENERATION	TONS PER DAY (TPD)
1	Total municipal solid waste generation	45.93
2	Street sweeping waste generation	9.87
	Total	**55.82**

Source: Egis Analysis

Cluster wise Municipal solid waste generation has been calculated based on residential population, working population and street sweeping waste. Classification of waste and quantification also provided in the table below:

Table 5.9: Cluster wise Municipal Solid Waste Generation with classification(In TPD)

CLUSTER NAME	TOTAL WASTE IN TPD	ORGANIC WASTE IN TPD	RECYCLABLE WASTE IN TPD	INERT WASTE IN TPD
Guttapadu	21.24	12.74	5.31	3.19
Komarolu Bit-I	8.18	4.91	2.04	1.23
Somayajulapalle	4.10	2.46	1.02	0.61
Pudicherla	11.37	6.82	2.84	1.71
Kannamadakala	6.61	3.97	1.65	0.99
Brahmanapalle	1.67	1.00	0.42	0.25
Komarolu Bit-II	2.36	1.41	0.59	0.35
Palakolanu	0.29	0.17	0.07	0.04
Total	**55.82**	**33.49**	**13.95**	**8.37**
Percentage	**100%**	**60%**	**25%**	**15%**

5.4.4 - Street Sweeping and Drain Waste

As the road length in Orvakal Industrial area increases, this category of waste is estimated to increase to a maximum limit of about 8-9 TPD. This is mainly inert waste. It shall be stocked at the waste management site and to be utilised suitably subsequently in filling and road construction. This along with the C&D waste can also be utilised for filing foundations of buildings that are going to be constructed over the years.

5.4.5 - Disposal of MSW

Segregated household waste will be collected from door to door, Institutional and organisational segregated waste will be collected directly from the source, common area waste will be collected from bins in the common areas. Collected waste will be transported to MSW site at Guttapadu. The proposed solid waste management plan with technological options provided in the table below:

Table 5.10: Solid waste management plan with technological options

Sl. No.	Waste Type	Management Facility	Material to be recovered/Disposal
1	Recyclable Waste	Material Recovery Facilities(MRF) at Guttapadu SWM site	Recyclable materials to be recovered and sold to authorized vendor.
2.	Organic Waste	Compost Plant: Technological options available for composting are as below: i. Windrow composting; ii. Aerated static pile iii. composting; iv. in-vessel composting; Decentralized composting (bin and box composting); v. Vermicomposting Considering all options Aerated Static Pile Biostabilizationis recommended and proposed at Guttapadu SWM site.	Compost as Fertilizer.
3.	Inert Waste	Landfill at Gargeyapuram.	Remaining inorganic/inert waste material along with rejects from the compost facilities will only be transfer to nearest landfill site at Gargeyapuram.
4.	Non-recyclable waste having calorific value of 1500 kcal/kg	Refuse derived fuel (RDF)manufacturing facility at Orvakal Industrial area or Nearby.	Refuse Derived Fuel for Industries.

5.4.5.1 - Recyclable Waste

Material recovery facility (MRF) will be established with in project area along with compost plant for segregation of waste. Segregated recyclable materials will be sold to the venders at regular frequency which will be used for production purpose.

5.4.5.2 - Organic Waste

Organic waste will be transferred to compost site located in Kurnool maintained by Kurnool Municipal Corporation.

5.4.5.3 - Inert Waste

Non-recyclable, non-biodegradable, non-combustible and non-reactive inert waste will be disposed of to the nearby authorized land landfill site located in the region

5.4.6 - Industrial Waste Management

Industrial waste generated from the industrial area will be reused or recycled as much as possible by collecting the waste separately. It is the responsibility of the waste generator to disposed of waste in accordance with the rule.

Industrial waste is defined as waste generated by manufacturing or industrial processes which includes any material that is rendered useless during a manufacturing process such as factories, industries, mills, and mining operations. There are several types of industrial waste, and while some is considered non-hazardous, some types are classified as hazardous. Legal and financial responsibility of the hazardous waste generator, starts from the time it is created to the time it is disposed of, whether it is inside the generator's property or not.

Industrial waste generated from the industrial area will be reused or recycled as much as possible by collecting the waste separately. This sorting out process is handled by each industries and cluster of industries and project proponent respectively.

The waste which cannot be reused or recycled may be managed by the designated waste treatment facility. Nearest TSDF for Hazardous waste located at Nellore (300 km).

Broader type of industrial waste will be as follows:

- Waste generated from the industry as a part of their industrial process.
- Sludge from CETP: This also includes sewerage sludge, chemical sludge etc.
- Reject from Raw material, Product or Maintenance.

Assuming total 0.25% generation of hazardous waste per day on the finished industrial goods, in Orvakal Industrial area.

5.5 - Power

The section will discuss the power requirements and the sources available from different units for the generation and distribution in the area and to make them available for the Orvakal Industrial Area. There will also be focus on the renewable energy and to make it available for Orvakal Industrial Area.

Power source is to be made available for the whole area for the Industrial development. The preliminary load requirement for the whole area of 9305.65 acres of land will be based on the different type of industries, commercial sectors, and residential uses excluding the existing industry of Jai Raj Ispat.

It is observed that the site and its surroundings are in a solar radiation rich zone with good number of sunny days. Kurnool district, and the nearby Sri YSR Kadapa district and Anantapur district already have atleast 10 number of small/ large solar energy power plants operational. There is a Kurnool Ultra Mega Solar Park at Gani, in Kurnool District of around 1000MW capacity.

5.5.1 - Power source

To identify the source of power which can cater to the need of 942 MW nearly for the complete project area, adjoin power sources were identified in the immediate surroundings of project area. The power demand for jai raj ispat is not considered as they meet their needs from their own substation.

- The three main grid lines are passing through project area mainly 220kV, 400kV and 765kV lines. Also, 400kV and 220kV lines are originating from GHANI Solar park.
- 400/220 kV Substation – Nannur: The Nannur substation is located 6km away from Guttapadu cluster, 2 km away from Pudicherla, 7km from Kannamadakala, 15km from Brahmanapalle& Palakolanu, 17km Somayajulapalle & 20km from Komarolu cluster. This substation will be the one of prime power source for Guttapadu, Pudicherla and Kannamadakala cluster.

- 765/400 kV Substation – PGCIL, Orvakal: Power Grid Corporation India Limited substation is located near Orvakal village. This substation is located 2.5km to Guttapadu cluster, 5km from Pudicherla cluster, 3km from Kannamadakala cluster, 6km from Brahmanapalle cluster. 10km from Somayajulapalle& Palakolanu, Komarolu Bit 2 and 15km from Komarolu Bit 1 clusters. This substation will be the one of prime power source for Guttapadu, Pudicherla, Kannamadakala & Komarolu Bit 2 & Palakolanu.
- 220 kV Switching Substation – Somayajulapalle: This substation is located 2km from Somayajulapalle cluster, 4km from Komarolu Bit2, Bit 1 and 5km from Palakolanu cluster. This substation will be the prime power source for these clusters
- 400/220 kV Substation – Gani&1000 MW – Kurnool Ultra Mega Solar Park: This Park is located nearly 4km from Brahmanapalle cluster, and 15km from other clusters. This project will the prime power source for major project area

5.5.2 - Power Requirement

The Power Requirements of the project is based on the land use pattern; the project area consists of mainly following type of loads.

- Industrial
- Residential
- Commercial
- Leisure and Hospitality
- Recreational and Entertainment
- Public (Community) Facility Zone
- Utilities and Others

The objective of carrying out power requirement assessment is to estimate the total power demand for total project area.

5.5.3 - Estimation of Power Consumption

5.5.3.1 - Industrial Plots :

Different industrial sectors have been projected for the said project area in previous submission. Considering the proposed industrial sector, this sector analyses the possible power consumptions.

The built-up area is calculated considering the FAR for residential and commercial land uses as 2 and for remaining land uses it is 0.75. According to the power demand estimates are calculated which are given below:

Table 5.11 - Assumption of Power consumption requirement- for different land uses

S.NO.	TYPE OF INDUSTRY	POWER CONSUMPTION (WATT/ SQ.M.)
1	Industries	70
2	Logistics	12
3	Amenities	30
4	Commercial	75
5	Utilities	20
6	Residential	25
7	Road	2
8	Open Space/Green	0.5
9	Parking	1.6

Note: Diversity factor: 0.9

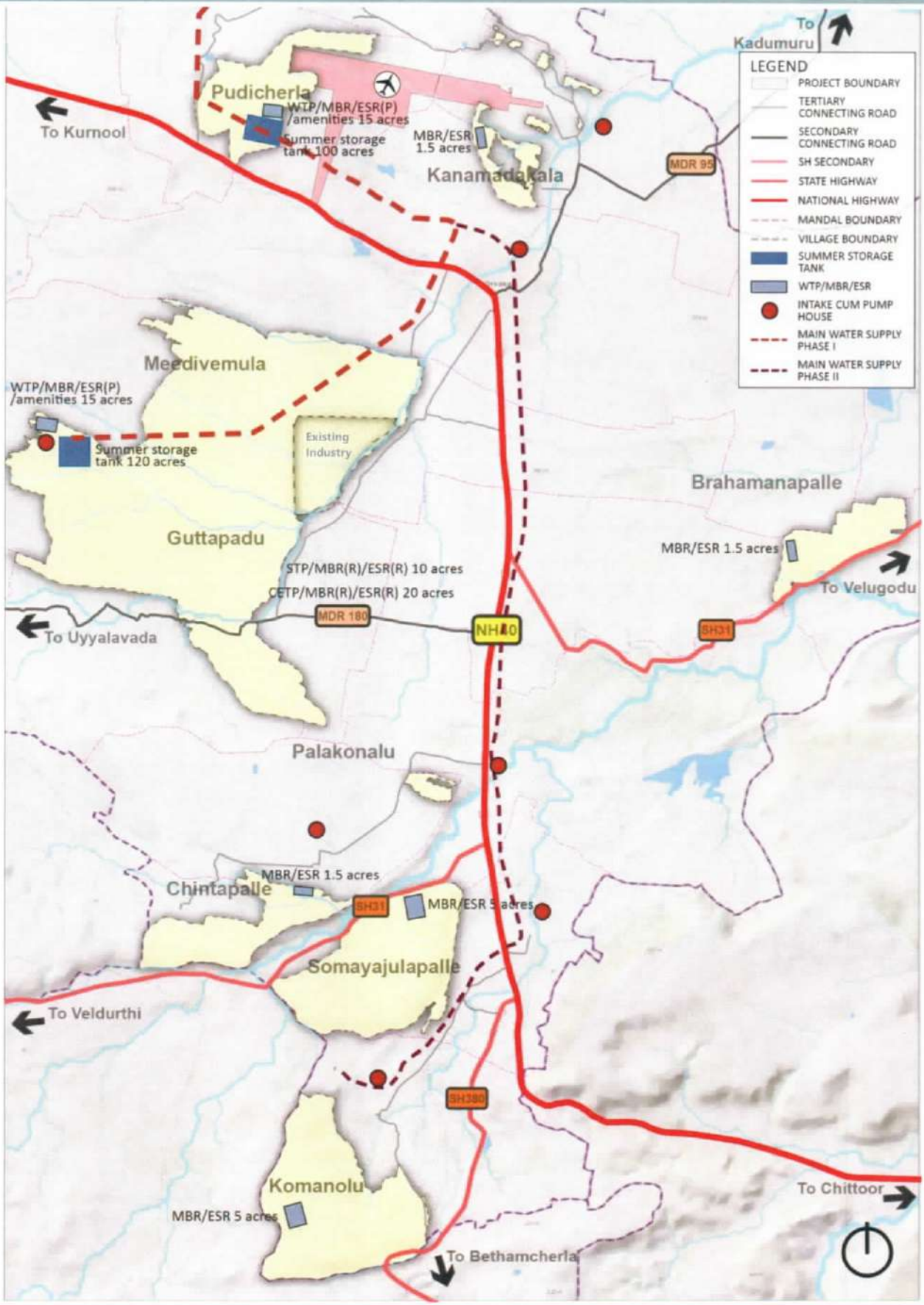
5.5.3.2 - Power demand estimation

Table 5.12 – Power demand Summary

CLUSTER	MVA
Guttapadu	582.91
Pudicherla	67.98
Kannamadakala	22.62
Brahmanapalle	55.35
Palakolanu	10
Somayajulapalle	104.23
Komarolu Bit 1	32.86
Komarolu Bit 2	65.22
TOTAL	**941.17**

Net Load Demand with Power Factor of 0.9 and Diversity Factor.of 0.9

Figure 5.4 - Proposed distribution network and water supply layout



Source: Egis Analysis

Table 5.1:Water Supply norms

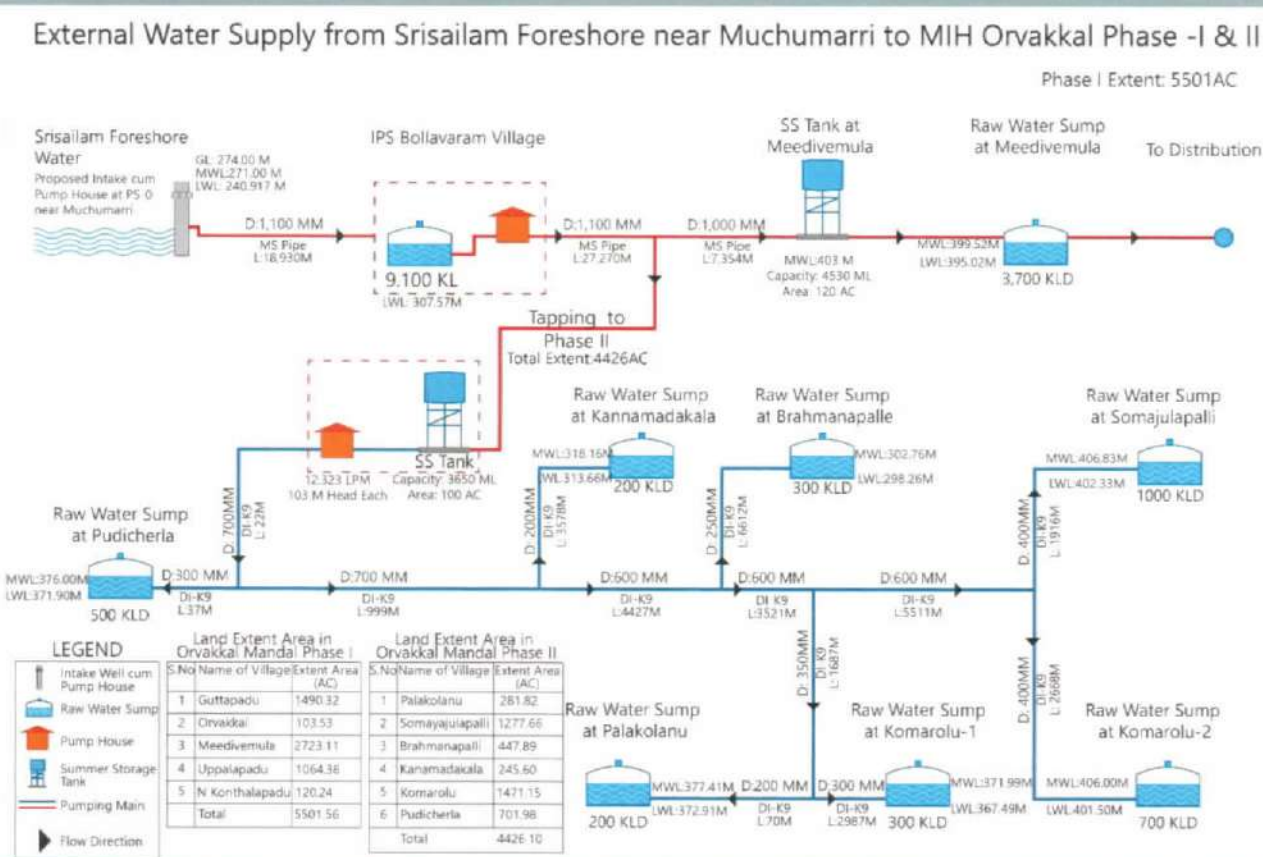
S.NO.	LANDUSE	POTABLE WATER	RECYCLED WATER	TOTAL	UNITS	REMARKS
8	Community facilities	15	30	45	Lpcd	As per CPHEEO manual
9	Fire Demand	15%	15%			As per CPHEEO manual
10	Losses	15%	15%			As per CPHEEO manual

Source: Egis Analysis

Based on the above norms the total water demand is estimated considering the land use patterns and industry types. Further fresh water and treated water demands are assessed.

Proposed water demand is worked in detail for final master plan. The Net water demand estimated for OMIH together with demand for fresh and recycled water (non-portable and Horticulture) and compensation for the losses due to transmission, treatment and distribution losses is estimated to arrive at the gross water demand. In general, it is considered that 60% wastewater is catered by recycling of industrial and domestic effluents that includes industrial process water, residential, commercial water demand, fire-fighting demand, and demand for green area development.

Figure 5.3 – External Water Supply



Source: External Water Supply DPR for Orvakal Node

Source: Egis Analysis

The treated water from WTP will be pumped to Mass Balancing Reservoirs (MBR) through the pumping machinery for further distribution. Through a transmission main network, treated water will be supplied to other MBRs or Elevated Service reservoir (ESR) at individual land parcels, maintaining a uniform pressure water supply. It will be supplied under gravity to consumer clusters/ plots for 24 hours at constant head depending on the hourly water demand pattern to the individual/ local level sumps. A planned transmission network will take care of variation in demand over the 24 hours and further pumping into reservoirs can be at a constant flow rate and withdrawals from the reservoirs can be as per fluctuating water demand.

5.1.2 - Water Demand Assessment

Water demand estimation is considered by dividing the project area into 9 water supply zones and across 2 phases based on the following:

- Non-contiguous nature of land parcels and closely distanced from NH-40.
- Phase 1- primarily west of NH-40, while Phase -2 includes land parcels primarily east on NH-40 or south of phase-1 on the west of Nh-40
- Proposed water supply route follows the natural downward gradient
- Minimum depth of excavation
- Wherever possible adjoining pipeline routes through restricted areas/ plots etc.
- Wherever possible avoiding crossing railway crossing, natural streams etc.
- Minimise no of road crossing
- Water demand for Jai Raj Ispat- Exisitng Industry is not considered in demand calculations

Water requirement for the proposed project shall primarily depend on the land use, population, land area built up area etc. Ultimate Population is assessed based upon final Master plan. Apart from above, various social infrastructures are also planned for the project which shall come up in the public purpose land. Population for the social infrastructure will be estimated as per norms.

5.1.3 - Technical Assessment of Raw Water Sources

The estimation of water demand has been done based on the usage-wise norms given in National Building Code, 2005 and CPHEEO Manual on Water Supply and Treatment. The norms have been further split into demand for potable and non-potable use and are given in table below.

Table 5.1:Water Supply norms

S.NO.	LANDUSE	POTABLE WATER	RECYCLED WATER	TOTAL	UNITS	REMARKS
1	Residential	105	45	150	Lpcd	As per CPHEEO manual
2	Commercial / Retail	15	30	45	Lpcd	As per CPHEEO manual
3	Hospital (more than 100 beds)	405	45	450	Per head	As per CPHEEO manual
4	Industry - Workers	15	30	45	Per person	As per CPHEEO manual
5	Industry - Process Water	15		15	KL/Ha/day	As per Industry Experience
6	Chemical / Heavy water-based Industry	15		15	KL/Ha/day	As per Industry Experience
7	Green/Parks			4	L/sqm	As per CPHEEO manual

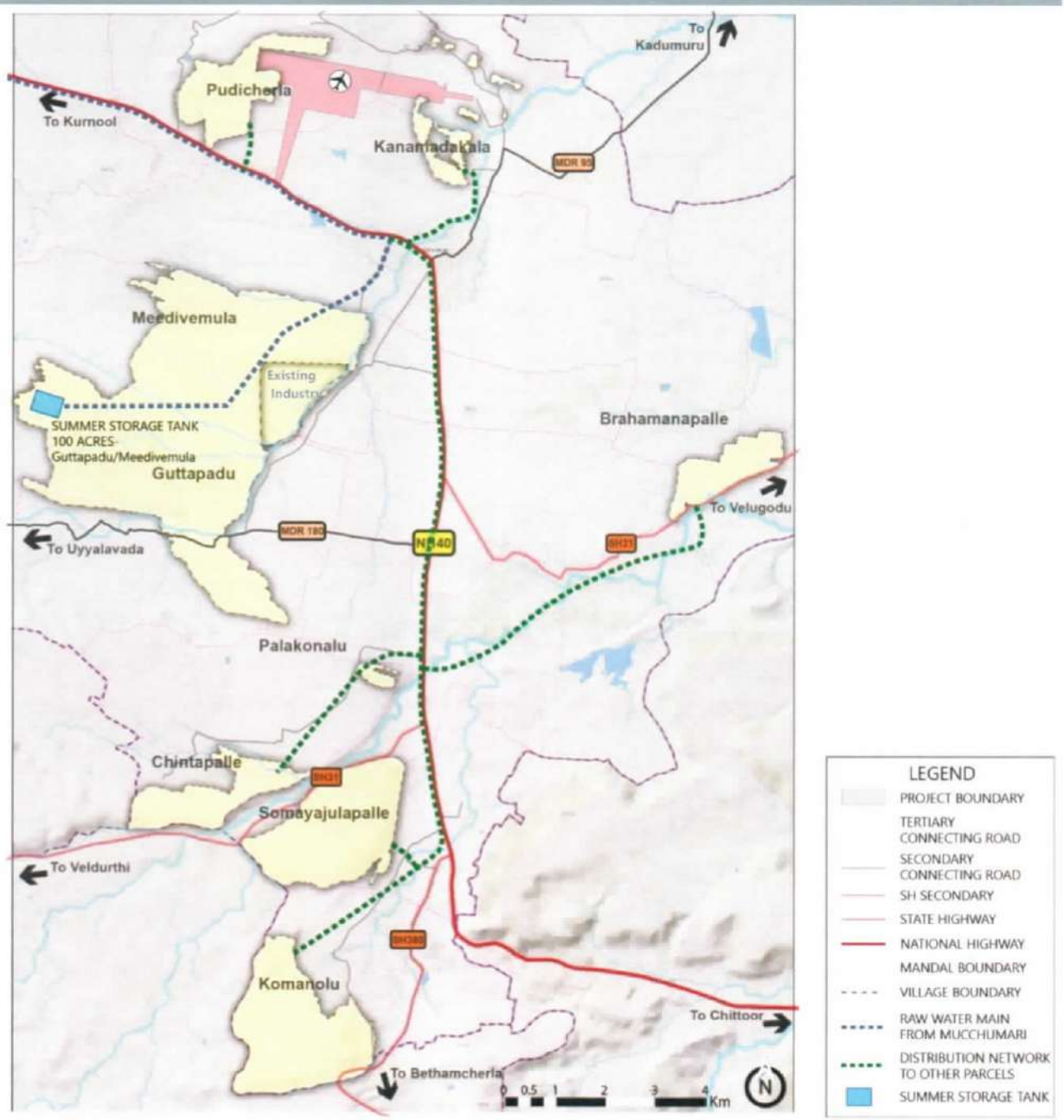
The following benefits of the tapping point:

- At Srisailam foreshore HNSS lift station, direct side intakes can be constructed close to reservoir as reservoir water quality is good and scope of pollution is minimum, directly water received from Tunghabhadra river.
- Shortest route ends near project area at an elevation of 385 m which is the highest point within the entire project at SS location

Raw water from IPS at Bollavaram village (9.100KL) is pumped through raw water submerged transmission pipeline is proposed along village road to Guttapadu cluster. The raw water will be stored in Summer Storage tank (SS) within the Guttapadu cluster at elevation level of 385m. WTP will be proposed to process the raw water is located adjacent to the SS tank at elevation of 395m.

The WTP is planned to be constructed in a phased manner on modular basis and total land reserved for WTP includes the 1-day treated water storage over an approximate 12 acres of land in Guttapadu cluster.

Figure 5.2 – Proposed transmission main network to summer storage tank at Guttapadu and Pudicherla



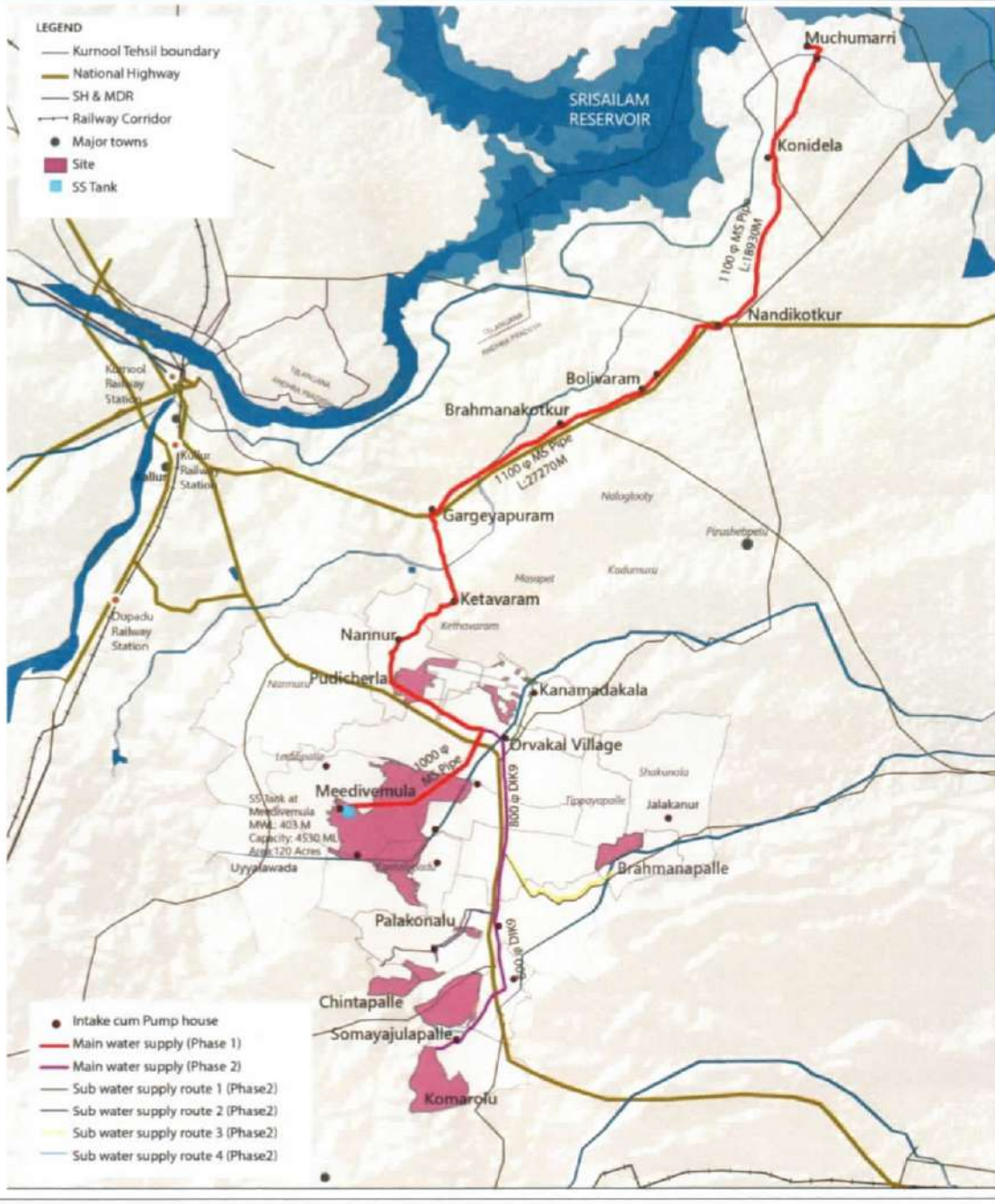
5 - DETAILED INFRASTRUCTURE

5.1 - Water Supply

5.1.1 - Water Supply Conceptual Scheme

Srisailam foreshore at HNSS lift station – zero at Muchumarri village shall be the primary source of water for this area and at present, it also supplies for irrigation facilities to 6.025 Lakh acres (Khariff ID) in the four districts of Rayalaseema and supply of drinking water to about 33 Lakh People, utilizing 40 TMC of flood water from the Krishna River. Orvakal Industrial Area has been allotted 74 MLD, for an overall project area of 9305.65 acres excluding jai Raj ispat exisitng industry. Hence, the raw water will be drawn from intake well at Muchumarri and again pumped from Intermediate Pumping station located at Bollavaram village to the summer storage tank.

Figure 5.1:Water Supply norms



Source: Egis Analysis

5

DETAILED INFRASTRUCTURE